5

Supply, Market Power and Return of Resources

ANALYSIS OF GLOBAL AND HISTORIC DATA leads to the conclusion that return to agricultural labor remains more or less chronically depressed below that of other sectors under continued economic growth. We found this condition to prevail because of two major reasons: the tendency in highly developed economies for supply to grow more rapidly than food demand, and the low elasticity of short-run supply in respect to commodity price. But the commodity supply function doesn't "just happen." Its existence and nature rest almost entirely on resources: the nature of the (1) production function for resources, (2) resource supply functions, (3) price structures of resources and (4) technology representing transformation of resources into commodities. If the coefficients relating to these relationships of resources are known, then the commodity supply function is largely known, given the human agent and its goals and strategies in using resources.

We must examine the nature of resource production and supply functions and their pricing in order to take the step to commodity supply. Still, the path isn't "one way." Commodity supply, when put against commodity demand, leads to the marginal value productivity and demand for resources. Too, it thus relates to the return of resources. We must unravel this complex if we wish to prescribe commodity supply which does not cause persistent depression of factor returns in agriculture relative to other sectors. Supply which grows faster than food demand is not per se an unequivocal reason why resource returns must be low; neither is low elasticity of commodity supply. Resource returns could be as high under these conditions as under their opposite. The reason they are not rests on the structural or behavioral relations surrounding the resources themselves. Hence, our first task in this chapter is to "unravel the system," stretching from resource to commodity supply and back again to resource returns, with some degree of detail and refinement but not in degree of manipulation which overburdens the subject matter. Then we examine some of the particular supply conditions surrounding these resources, with emphasis on labor.

Laborers are farm operators and consumers—the reason that impact of economic growth on agriculture is of human concern. If all farm resources were inanimate, we could restrict analysis and policy to cold views of economic development in the long stretch of history and materials. We could concern ourselves only with quantities of resource, labor in this case, which might be manipulated. But for each labor input diminution or expansion involved, the decision or migration of a person and family is concerned. It isn't neutral or passive, as is the capital which serves as substitute or complement for it. Lack of communication between economists and people or politicians often arises for this reason. People who make up the magnitude of the X_i don't view it in this degree of abstraction. Even though they do react, in general, in the manner and approximate magnitude of coefficients which can be used for operation on the X_i, the change in the magnitude for a region or the U.S. requires tearing people loose from their moorings. To some, this is pleasant. And to some it is the opposite. We do turn to some abstractions, not in lack of sensitive regard for human resources which must shift to bring changes in marginal and price quantities, but to indicate the quantities important in earnings where resources may lack mobility or supply elasticity because of human or other attachment to occupation and location.

FACTOR SUPPLY IN RELATION TO RETURNS

The effect of factor immobility on its own price, and hence on the magnitude of the supply function and tendency towards constancy in output, was mentioned in the previous chapter. We now illustrate more precisely the path between resource supply elasticity and commodity price, and then back to resource return.

The marginal value productivity and money return of a resource can be maintained if resource quantity responds sufficiently to the conditions of commodity demand and factor pricing which surround it. As a first simple example illustrating these possible interrelationships, we use the production function in (1.1) and the commodity demand function in (5.1).

$$Q_d = cP^{-e} \tag{5.1}$$

$$Q_1 = \pi K^b \tag{5.2}$$

$$P_1 = (\pi^{-1} c K^{-b})^{e^{-1}} \tag{5.3}$$

$$MVP_1 = b(\pi^{e-1}\, c K^{eb-e-b})^{e^{-1}} \tag{5.4}$$

As an extreme in resource mobility or supply response, suppose that resource quantity is originally fixed at $X=K$. The corresponding supply or quantity of product then is (5.2), since we initially suppose supply elasticity of resources is zero, the resource used at whatever return realized. Hence, the commodity equilibrium price is (5.3) and the marginal value productivity of resources is (5.4), obtained by multiplying the price of (5.3) by the marginal physical product—the derivative of (1.1). If now demand increases to the proportion λ of original (5.1) and the production function is similarly increased by multiplying the original function by Γ, the corresponding static supply quantity and equilibrium commodity price are respectively (5.5) and (5.6). The new marginal value product then becomes that of (5.7).

$$Q_2 = \Gamma Q_1 \tag{5.5}$$

$$P_2 = \lambda^{1/e}\Gamma^{-1/e}P_1 \tag{5.6}$$

$$MVP_2 = \lambda^{1/e}\Gamma^{(e-1)/e}MVP_1 \tag{5.7}$$

The latter quantity will now decrease if the shifter for technology or the production function is great relative to the shifter for the demand function. Marginal value productivity of a given quantity of resources will remain at the previous level if the technology or production shifter is of the magnitude in (5.8). (See discussion of equation (7.8) where numerical elasticities are used.) If it is larger than this, marginal value productivity of the given quantity of resources will decline.

$$\Gamma = \lambda^{1/(1-e)} \tag{5.8}$$

$$X = (\lambda^{-1}\Gamma^{1-e})^{1/(eb-e-b)}K \tag{5.9}$$

Even though marginal value productivity for a given quantity of resources does decline, the marginal value product of resources can be maintained, of course, by decreasing their quantity.

How large must the quantity, X, of resources be after increase in demand and production functions, if the marginal value productivity of remaining resources is not to decline? It must decline to the magnitude or proportion of K, indicated in (5.9). Here, then, we have the proportion of resources to be retained in the industry as a function of commodity demand elasticity and the rate of increase in the demand and production functions.

Similarly, if the quantity of resources remains at K, the resulting value productivity or average resource returns also is a function of the elasticities and the supply and demand shifters. Table 5.1 includes, for the example under discussion, the (1) magnitude of marginal value product if resources remain at K quantity and (2) the proportion by which resource input must change if marginal value productivity is not to decline, for selected magnitudes of elasticities and structural shifters. For all of these situations we suppose the production elasticity in (5.2) to be .4, or $b=.4$. When the multipliers of the production and demand func-

TABLE 5.1

EFFECT OF PRICE ELASTICITY OF DEMAND AND SUPPLY AND DEMAND SHIFTS ON MARGINAL RESOURCE PRODUCTIVITY AND INPUT MAGNITUDE

Demand Elasticity (Price)	Magnitude of Marginal Value Product With Resources Input Constant at K		Magnitude of Resource Input To Maintain Marginal Value Product	
	$\Gamma=1.25$, $\lambda=1.25$ (Input $=K$)	$\Gamma=1.25$, $\lambda=1.18$ (Input $=K$)	$\Gamma=1.25$, $\lambda=1.25$	$\Gamma=1.25$, $\lambda=1.18$
.1	1.25 MVP_1	.70 MVP_1	1.05 K	.93 K
.2	1.25 MVP_1	.94 MVP_1	1.09 K	.97 K
.4	1.25 MVP_1	1.08 MVP_1	1.16 K	1.05 K

tions are equal, $\Gamma=\lambda$, the marginal value product for K quantity of resources increases to a corresponding magnitude of the original magnitude. For example, with Γ and λ both equal to 1.25, the new marginal value product is 1.25 proportion of the original marginal value productivity. The marginal value productivity increases because commodity price has remained constant but physical resource productivity has increased. However, when the production function is increased by 1.25 proportion but the demand functions by only 1.18 proportion, the marginal value productivity takes on different values, depending on demand elasticity. With a price elasticity of only .1, the marginal productivity of K magnitude of resource is only .7 as great as originally when production and demand functions were those in (5.1) and (5.2). With an elasticity of .2, the marginal value productivity of K inputs is only .94 of the original for $\Gamma=1.25$ and $\lambda=1.18$. But with demand elasticity at .4, marginal value productivity increases above the original level.

Now examining the magnitude of resource necessary, after shift of the production and supply functions, to maintain marginal value productivity at the original level, we find that input could actually increase regardless of demand elasticity when $\Gamma=\lambda$ or the two shifters are of the same magnitude. However, when the increase for the production function exceeds that for the demand function, the magnitude of input must be changed, if the marginal value productivity is to be equal to the original magnitude with input at K level. With demand elasticity of .1 and .2, input must decline to .93 K and .97 K levels respectively. Otherwise, if it remains at K level, the marginal value products drops to .70 or .94 proportions of original level respectively. If, however, demand elasticity is .4, the amount of resource can increase to 1.05 K level, marginal value product remaining at the original level. The latter increase is possible, even under an inelastic commodity demand and increase in production which is greater than increase in demand.

Obviously, from the above, the effect of structural change on resource returns, or the quantity of resources necessary to maintain a given return, depends upon the rate of change in technology, commodity demand and the relative elasticities attaching to these relationships. Evidently, in American agriculture, the marginal value productivity of resources "fixed to agriculture in the short run" has declined even with an increase in their physical productivity, due to the low price elasticity of demand and a rate of technical change which has been great relative to the change in demand. Even under these conditions, marginal value productivity could be maintained by a decrease in inputs. In Table 5.1, for example, with an increase in the production function to 1.25 proportion and in demand to 1.18 proportion with demand price elasticity at only .1 level, marginal productivity could be maintained if input declined to .93 proportion of original K level. This is, of course, the problem of broad sectors of American agriculture.

Rate of change in production and demand functions and magnitudes of elasticities were such that return on labor and specialized capital of inelastic supply began declining in the 1950's.[1] To maintain previous levels, or to keep returns moving up with those in other sectors under economic development, diminution in quantity becomes necessary unless compensation price policies are applied which offset the relative differences in increase of demand and supply and the inelasticity of factor supply. A policy of this nature can increase or maintain returns to resources, but it does not overcome the problem of low resource supply elasticity.

An alternative in maintaining resource returns is to increase elasticity of resource supply. The possibility here is illustrated in Table 5.2, where the production function is $Q_p = \pi X^{.4}$ and the demand function is $Q_d = cP^{-.4}$ for all situations, with these quantities being multiplied respectively by Γ and λ proportions to represent change for the bottom half of the table. We use four conditions of factor supply elasticity, with each being compared with itself before and after change. In the first case it is zero, with supply fixed at K. In two other cases, own price elasticity of resource supply is .1 and .5. In the final case, elasticity is infinite and the industry can obtain an unlimited quantity of resource at the economy-wide price of P_x. As the column of resource prices indicates, increase of technology by Γ and of demand by λ causes factor price to decline more for the situation where factor supply is less elastic, and to decline less in situations where factor supply is more elastic. In the case where factor supply is infinite, factor price is at level P_{x1} both before and after change in demand and technology. Conversely, the change in factor input where Γ is large relative to λ, is greatest for larger factor supply elasticity and smallest for lower elasticity. In the case of perfectly inelastic factor

[1] To keep the example simple, the Γ proportionate change in the production function was supposed without cost attached to it. Of course, technology does not change apart from costs. Had these costs been added in, as they are at a later point, the net value marginal productivities could be maintained only with resource adjustments somewhat larger than those suggested in the text example. Had we considered average return to the resource, the conditions would have been as follows for K quantity of resources and the functions of (5.1) and (5.2). The average return under the original situation is R_1 and under the change of production and demand functions is $R_2 = (\Gamma^{\epsilon-1}\lambda)^{1/\epsilon}R_1$. Hence, the magnitude of change in resource input to maintain a given return per unit of resource is that indicated in the last column of Table 5.1 to maintain a given marginal productivity.

TABLE 5.2

EFFECT OF FACTOR SUPPLY ELASTICITY ON COMMODITY AND FACTOR PRICES AND FACTOR EMPLOYMENT

Factor Supply	Commodity Demand	Commodity Price	Factor Price	Factor Quantity
K	$cP^{-.4}$	$P_1=\pi^{-2.5}c^{2.5}K^{-1}$	$P_{x1}=.4\pi^{-1.5}c^{2.5}K^{-1.6}$	$X_1=K$
$wP_x^{.1}$	$cP^{-.4}$	$P_1=1.331w^{-.8681}\pi^{-2.3707}c^{2.2845}$	$P_{x1}=.454\pi^{-1.2931}c^{2.1552}w^{-.7663}$	$X_1=.962\pi^{-.1293}c^{.2155}w^{.8621}$
$wP_x^{.5}$	$cP^{-.4}$	$P_1=1.750w^{-.5556}\pi^{-2.0833}c^{1.8056}$	$P_{x1}=.601\pi^{-.8334}c^{1.3889}w^{-.8889}$	$X_1=.775\pi^{-.4167}c^{.6944}w^{.5556}$
∞	$cP^{-.4}$	$P_1=1.773\pi^{-1.5625}c^{.9375}P_x^{.6250}$	$P_{x1}=P_x$	$X_1=.564\pi^{-.9375}c^{1.5625}P_x^{-.6250}$
K	$\lambda cP^{-.4}$	$P_2=\Gamma^{-2.5}\lambda^{2.5}P_1$	$P_{x2}=\Gamma^{-1.5}\lambda^{2.5}P_{x1}$	$X_2=X_1$
$wP_x^{.1}$	$\lambda cP^{-.4}$	$P_2=\Gamma^{-2.3707}\lambda^{2.2845}P_1$	$P_{x2}=\Gamma^{-1.2931}\lambda^{2.1552}P_{x1}$	$X_2=\Gamma^{-.1293}\lambda^{.2155}X_1$
$wP_x^{.5}$	$\lambda cP^{-.4}$	$P_2=\Gamma^{-2.0833}\lambda^{1.8056}P_1$	$P_{x2}=\Gamma^{-.8334}\lambda^{1.3889}P_{x1}$	$X_2=\Gamma^{-.4167}\lambda^{.6944}X_1$
∞	$\lambda cP^{-.4}$	$P_2=\Gamma^{-1.5625}\lambda^{.9375}P_1$	$P_{x2}=P_{x1}$	$X_2=\Gamma^{-.9375}\lambda^{1.5625}X_1$

supply, input remains at K, after change in both the production and demand functions by Γ and λ, and adjustment is in factor return or productivity. But in the opposite case, perfectly elastic factor supply at the economy-wide price, factor price remains at the same level and adjustment is in quantity of factor.

While the derived relationships are in the sense of static concepts, and for particular forms and magnitudes of relationships, they illustrate the possible and expected effect of factor supply elasticity upon the value return and magnitude of input. Too, it is evident that resource returns and employment in agriculture do parallel these conditions, with modification in time lag and other quantities relating to decisions and investment.

Magnitude of Input Under Change

Whether resources employed in an industry will expand or contract under economic growth depends particularly upon the demand elasticities for the commodity and the rate of technical or economic development within the industry. Looking back to Chapter 2, we see a tremendous increase in farm output over 30 years. Under constant technology, this increase would have required larger inputs of conventional form and would have favored high returns to them, with rewards in the short run greatest for resources with low supply elasticity. As Figure 2.8 illustrates, however, this greater output has come with a large decline in labor input, capital resources serving to substitute for labor. Input of particular capital forms has grown tremendously. However, as Table 2.13 indicates, the greater output of later periods has been possible with only a slight increase, or an almost constant quantity, of aggregate inputs.

These conditions, of a decline required in a particular input or of constancy in aggregate resource employment, do not favor high resource returns as would be true in the case where growth in commodity demand and slow rate of technical progress also required large increase in employment of resources. This is true especially when the resources which must be ejected from the industry lag in their response to price relatives and tend to be immobile in the short run. The immobility, as mentioned previously, causes supply to hang heavily over demand, depressing commodity prices and factor returns. In the food industry, this condition of low response elasticity of resources favors the consumer. Total expenditures for food at the farm level are less, under low price elasticities of commodity demand, than would hold true under great mobility of resources used for farming. In an undeveloped country where technical development of agriculture is tardy and population and per capita income are growing, growth in food demand would call for more resources in agriculture. If the elasticities of the production and factor supply functions were low, prices of food and expenditure on it at the farm level would grow. Resources would be drawn into agriculture and their real income would increase somewhat inversely to their supply elasticity.

As further illustration of the effect of economic development on resource employment and income in an industry such as agriculture, we refer again to the production function in (1.1) and the demand function in (5.1). The corresponding supply function is (5.10), where P_x is factor price and P is commodity price. The equilibrium price is (5.11) and the corresponding static equilibrium resource input is (5.12).

$$Q_s = (b\pi^{b^{-1}} P_x^{-1} P)^{b/(1-b)} \tag{5.10}$$

$$P = (b^{-b} c^{1-b} \pi^{-1} P_x^{b})^{1/(b+e-eb)} \tag{5.11}$$

$$X_1 = (b^e c \pi^{e-1} P_x^{-e})^{1/(b+e-eb)} \tag{5.12}$$

If increase in supply amounts to multiplication of the production function by Γ and the demand function by λ, the new equilibrium in resource input, X_2, is that in (5.13).

$$X_2 = (\Gamma^{e-1}\lambda)^{1/(b+e-eb)} X_1 \tag{5.13}$$

Now, if under change in technology and shift in demand, input is not to decline, the multiple of the production function must bear the relationship in (5.8) to the demand shifter. Factor input must decline, with increase in demand and change in technology, if the technology shifter exceeds the demand shifter raised to the power $(1\text{-}e)^{-1}$. If e, demand elasticity, is large, the value of Γ can be great; if e is small, Γ must be smaller if input is not to decline under orthodox market equilibrium. Hence, under change of demand and economic development, the total quantity of resources to be retained will depend on the elasticity of demand as well as the rate at which demand and production shifts.

Table 5.3 indicates the effect of these magnitudes, for the particular functional forms, on the equilibrium quantity of resource after change in technology and demand. With a price elasticity of demand of only .1, the production function can shift only at the rate $\Gamma = 1.112$, if demand shifts at the rate $\lambda = 1.10$ and resource input is not to decline. For demand elasticity at .9, technology can shift at the rate 2.594 with $\lambda = 1.10$ and decline in resource employment does not occur. However, if Γ is greater than 2.594, with $\lambda = 1.10$, resource employment must decline if factor supply has some elasticity and return to the factor is not to decline. With a high rate of population and demand growth, $\lambda = 1.25$, and a large price elasticity, $e = .9$, the shifter for the production function could be as great as 9.313 without causing a diminution in resource employment. For values of Γ greater than 9.313, resources would be ejected from the industry, but for values of Γ smaller than 9.313 resources would be drawn into the industry. With values of Γ greater than that allowed by the demand elasticity and shifter, resources could be freed from the industry. Of course, if they are relatively immobile, the process of freeing them will cause them to be surplus in the industry, with a larger total output and a smaller marginal value product per unit of resources, as compared to a situation where their supply is highly elastic to the industry.

TABLE 5.3

EFFECT OF DEMAND ELASTICITY AND RATE OF DEMAND SHIFT ON STATIC EQUILIBRIUM OF RESOURCE INPUT (FIGURE IN CELL INDICATES VALUE FOR Γ IF INPUT IS TO REMAIN UNCHANGED)

Value of Demand Elasticity, e	Value of Demand Shifter, λ				
	1.05	1.10	1.15	1.20	1.25
.1	1.056	1.112	1.168	1.227	1.281
.3	1.073	1.146	1.221	1.298	1.376
.5	1.103	1.210	1.322	1.440	1.562
.7	1.176	1.373	1.592	1.835	2.102
.9	1.626	2.594	4.046	6.192	9.313

In an aggregate sense, change in technology of American agriculture has been fast enough, given the low price elasticity of commodity demand, to allow food "requirements" of a growing population to be met with almost a constant level of aggregate input over the years 1940–60. In fact, had labor withdrawn in the industry to an extent allowing returns equal to levels of nonfarm sectors, and to the extent of the farm organizational possibilities that exist, aggregate measure of input in Table 2.13 might show a clear-cut decline. But the underlying problem of American agriculture under economic growth is more than a rate of change in technology which exceeds the rate of growth in demand, or even of rates of changes wherein demand for aggregate inputs remains almost constant while output and commodity demand grows. It is one wherein requirements and demand for labor decline by large absolute amounts but labor supply elasticity to agriculture remains low in relation to rate of change in productivity. The problem is aggravated by the fact that technological improvement increases the marginal rate of substitution of capital for labor in agriculture, the change in substitution rate and the relative price of labor and capital both favoring the replacement of labor by capital over time.

These effects can be illustrated by the demand function in (5.1) where we assign the price elasticity of demand $e = .2$ and the industry production function is (5.14) where we suppose Z to be input of one resource and X to be input of another. (For explanation of the method see the footnote on page 21 referring to equations 1.1–1.5.)

$$Q_p = rZ^{.4}X^{.4} \tag{5.14}$$

$$Q_s = .0256r^5P_x^{-2}P_z^{-2}P^4 \tag{5.15}$$

With P_x, P_z and P being the prices respectively for X, Z and commodity, the static supply function is (5.15).[2] The equilibrium price and

[2] Equation (5.15) has been derived by computing the isocline equation $Z = P_xP_z^{-1}X$ and substituting this into (5.16). X has then been derived as $X = r^{-1.25}P_x^{-.5}P_z^{.5}Q_p^{1.25}$. These values of X and Z are substituted into the cost function $C = P_xX + P_zZ$, to express cost as a function of output and derive supply accordingly.

TABLE 5.4

LEVELS OF PRICE, OUTPUT, INPUTS AND REVENUE AFTER CHANGE IN TECHNOLOGY AND DEMAND (WITH $c=.48$, $r=2$, $P_x=\$2$ and $P_z=\$4$)*

Value of:		Equilibrium Price	Equilibrium Output	Equilibrium Input of:		
Γ	λ	P	Q	Z	X	Revenue
1.0	1.0	2.370	.404	.096	.191	.957
1.2	1.1	2.082	.445	.092	.237	.926

* The first line refers to the original demand and production function in (5.14) where $\Gamma=1.0$ and $\lambda=1.0$ and both elasticities of production are .4. The second line refers to the new situation in (5.20) and (5.21) where $\Gamma=1.1$ and $\lambda=1.2$.

outputs are (5.16) and (5.17) while the equilibrium inputs are (5.18) and (5.19) respectively. Their values are in the first row of Table 5.4 for specified quantities of factor prices and coefficients. Now, if technology changes to give the production function in (5.20), the marginal productivity of both factors increases and the marginal rate of substitution of X for Z also increases.

$$P = 2.3933c^{.2381}r^{-1.1905}P_x^{.4762}P_z^{.4762} \tag{5.16}$$

$$Q_s = .8399c^{.9524}r^{.2308}P_x^{-.0952}P_z^{-.0952} \tag{5.17}$$

$$X = .8041c^{1.1950}r^{-.9525}P_x^{-.6190}P_z^{.3810} \tag{5.18}$$

$$Z = P_xP_z^{-1}X \tag{5.19}$$

$$Q_p = \Gamma r Z^{.4}X^{.5} \tag{5.20}$$

$$Q_d = \lambda c P^{-.2} \tag{5.21}$$

With an increase in demand to that in (5.21), a new set of equations for equilibrium prices, outputs and inputs arise and parallel those for (5.16) through (5.19). The new quantities are expressed in the second row of Table 5.4 in numerical example where we have arbitrarily used the values $c=.48$, $r=2$, $P_x=\$2$ and $P_z=\$4$. For all cases we suppose that demand increases to $\lambda=1.1$, but technology improves to $\Gamma=1.2$ with the elasticity of X increasing to .5 as in (5.20). With the rate of "growth" in technology twice that of demand, the equilibrium price declines from 2.370 to 2.082 and output grows from .404 to .445. Input of Z declines from .096 to .092 while input of X increases from .191 to .237. The decline in magnitude of Z arises because both (1) the rate of increase in transformation of resources is large against an inelastic demand which increases at a smaller rate and (2) the marginal rate of substitution between factors has changed.

This is roughly the situation which has held true in U.S. agriculture, with labor input being comparable to Z and capital comparable to X. In addition, and in contrast to the example where factor prices are the same before and after the change, the price of labor has risen relative to capital items (Table 2.10), further encouraging the substitution of capital for labor. As in our example, not only has price and input of Z

declined, but total revenue is also less. In our illustration, however, we have supposed supply of Z to be sufficiently elastic that its marginal value productivity can remain at market price of the factor.

Unfortunately, elasticity is not this great in agriculture and labor returns tend to remain depressed. As our example shows, however, it would be possible for factor to maintain marginal productivity at "outside wage rate or price," even under inelastic demand, technology increasing faster than demand and marginal rate of substitution of capital for labor increasing. Even with decline in industry price and revenue, this would be possible if factor supply were sufficiently elastic.

FACTOR SUPPLY ELASTICITY, MONOPOLY POLICY, INPUT MAGNITUDE AND RESOURCE RETURNS

Level of commodity price is not a gauge of farm problems because it fails to take into account the rate at which resources are transformed into product or the prices of resources. Commodity prices can be low without an income problem to producers or an allocative problem to society, if transformation rates are large and factor prices are low. Conversely, an income and allocative problem can exist under high commodity price if transformation rates are low and factor prices are high.

We have seen that rates of increase in resource productivity which exceed rates of increase in demand need not lead to low resource returns. Even though it is necessary for resources to be ejected from an industry, as labor from agriculture, level of resource return can be maintained at the level of other industries if the rate of outflow is great or rapid enough. The outflow rate, of course, gives rise to a problem because, as noted before, people are not passive resources with lack of values and orientation to particular communities and occupations. It is this low elasticity of factor supply which causes commodity prices to fall to levels causing continuous short-run depression of resource return.

The problems of supply elasticity and low resource return have importance particularly in respect to labor. As noted previously, capital resources also take on low supply elasticity and remain in the industry at low returns once they have been committed to material forms unique to agricultural production. Still, if there were great enough flexibility in labor, the problem of low short-run supply elasticity for capital would be less critical. If reduction of labor input were of sufficient magnitude, output could be diminished and return to capital resources increased. As we have seen, such adaptation in short duration of time would require a drastic uprooting of labor in agriculture. Too, it is unlikely that the more normal rates of migration can easily lead to any prolonged reduction in output if, in fact, reduction is ever realized. Yet it is true that where problems of producer income and national allocative patterns revolve around the magnitude of resources employed in an industry, demand inelastic and given at a fairly stable level, the income problem has only two basic solutions: a reduction in product from the resources or a reduction in the quantity of resources. The first supposes some type of supply management or monopolistic production policy applied to the industry while the second supposes an attack on the mobility and supply elasticity of relevant resources. If all industries were organized optimally in terms of consumer sovereignty and free market equilibrium, monopolistic production policy would be consistent with greater farm income, but inconsistent with maximum consumer welfare. If, however, an important degree of monopolistic pricing and production policy exists elsewhere in the economy, consumer welfare need not be diminished by solution of low farm incomes and large resource commitment by use of monopolistic production policy. This is true only if resort to supply management and monopolistic production policy in agriculture causes resources to be allocated more nearly in the same productivity terms as other industries and if resources can remain fully employed.

If resources are allocated to and within agriculture in terms of marginal quantities based on average price or revenue and marginal physical productivity, while they are allocated to and within other sectors in terms of marginal quantities based on marginal revenue and marginal physical productivity, supply management or monopolistic production policy in agriculture could cause resource allocation to conform more nearly to consumer preference, providing, of course, that the same total level of resource employment is maintained. Hence, before final judgment can be made about the relevance of production control policy for agriculture, the extent of monopoly and its effect on resource employment in the rest of the economy must be gauged.

Agriculture is not the only industry with resource supplies of low elasticity. A parallel situation exists for petroleum and other industries, especially those with activity based on natural resource endowments. For example, the amount of petroleum available for exploitation, the supply quantity, is highly stable over a wide range of crude oil prices. The petroleum industry has tried to solve its problem of low factor supply elasticity, not by making petroleum deposits or supplies more elastic and causing them to "go away," but by certain formal and informal controls on resource inputs and commodity outputs.

The other avenue for solving income and allocative problems based on low factor supply elasticity, increasing the mobility of the resources, is consistent with general consumer welfare but may be inconsistent with the values and welfare of particular farm people. The extent to which this avenue is more relevant than monopoly policy for agriculture depends on (1) the magnitude of any conflict in utility attainment which may exist between these two groups, (2) the extent to which resource allocation in general is based on monopolistic or competitive pricing and (3) the extent to which compensation mechanisms are appropriate and acceptable in application so that while consumers in general gain, farm groups can be guaranteed against utility sacrifice.

We shall return to analysis of these alternatives in a later chapter. Meanwhile we continue our analysis of unique causes of low supply elasticity and return of agricultural resources. Thus far we have emphasized one cause of low factor supply elasticity, namely, conditions endogenous to the industry and relating to the unique physical, sociological and psychological attachments of farm resources. But resource commitment in a particular industry also may be large for reasons exogenous to the industry, and even in the face of high factor supply elasticity. This possibility would exist where major resource-employing sectors use monopoly pricing and production policies, while a minor part of the economy rests on competitive policy and must absorb resources excluded from monopoly sectors.

Monopoly and Competitive Effects in Resource Allocation and Returns

An exodus of labor has occurred in agriculture and will continue because of the three main reasons mentioned previously; (1) the rate at which resources are transformed into product has increased more rapidly than demand, (2) the production function has changed to increase the marginal rate of substitution of capital for labor and (3) the price of labor has increased relative to the price of capital, favoring substitution. Directly, people have moved out of agriculture because their incomes were low relative to possibilities from the same resources in other industries. But underneath, and while indirect but more fundamental, has been the complex of forces mentioned above. These forces, put against the low supply elasticity of labor to agriculture—relative to the demand for labor in farming—have caused price and resource incomes to be depressed below orthodox long-run equilibrium levels and to be less favorable than in other industries.

If the attack in solving the basic farm income problem is to be that of increased factor supply elasticity, another question must also be raised. Can other economic sectors absorb displaced farm labor as rapidly as it must be ejected from agriculture? The answer depends on the rate of economic growth and the extent of monopoly organization in nonfarm industry. Even with existence of some monopolistic organization, or oligopolistic structure leading to the same end, the rate of absorption of displaced farm labor could be high enough to boost resource returns in agriculture to comparable levels of other industries if rate of economic growth and employment creation were rapid enough. As we point out later, and over a longer period of time, the rate of national growth has particular importance to agriculture in future decades.

But let us return to the possible effect of monopoly and competitive structure on the level of resource prices and returns. To do so, let us suppose each of two industries with a commodity demand function defined by the price equation in (5.22), where Q is quantity and P is price of commodity. The production function of both industries also is identical as in (5.23). The marginal revenue equation, the derivative of the product of the price function and quantity, is (5.24).

$$P = a - .01Q \tag{5.22}$$

$$Q = 5X \tag{5.23}$$

$$MR = a - .02Q \tag{5.24}$$

$$\frac{dQ}{dX} = 5 \tag{5.25}$$

$$X_m = 10a - 2P_x \tag{5.26}$$

$$X_c = 20a - 4P_x \tag{5.27}$$

Multiplying marginal revenue (5.24) by marginal physical product (5.25), equating this quantity to P_x or resource price and solving for X, we obtain the monopoly industry resource demand function in (5.26). Multiplying average revenue (5.22) by (5.25) and proceeding similarly, we define resource demand for the competitive industry in (5.27). The total resource demand function, (5.26) plus (5.27), is (5.28).

$$X_t = 30a - 6P_x \tag{5.28}$$

$$X_s = 4P_x - 5a \tag{5.29}$$

$$P_x = 3.5a \tag{5.30}$$

With the factor supply equation in (5.29), we can equate supply and demand and solve for resource price as in (5.30).

With equilibrium price of $3.5a$ substituted into the factor demand equations, resource employment is $9a$ total, with $3a$ in the monopoly and $6a$ in the competitive industry. Hence, under these conditions, the resource would be priced at equal level to the two industries. It would, however, have an entirely different level of return. The average return per unit of resource is $3.5a$ in the competitive industry and $4.25a$ in the monopoly industry. The marginal value productivity of resources differs even more, being at level of $3.5a$ in the monopoly industry and $2a$ in the competitive industry. If both industries were competitive, the total factor demand equation would be (5.31) and equilibrium factor price would be at the higher level of $3.75a$.

$$\overline{X}_t = 40a - 8P_x \tag{5.31}$$

$$\pi = PQ - P_xX = 12.75a^2 - 10.5a^2 \tag{5.32}$$

The equilibrium input also would be larger, totaling $10a$, with $5a$ to each industry. Average and marginal revenue would be the same in both industries, amounting respectively to $3.75a$ and $2.5a$ per resource unit. Resource employment in the competitive industry would decrease between the two situations, from $6a$ to $5a$. Employment in the monopoly industry would increase from $3a$ to $5a$, and output would decline from $30a$

to $25a$. Average return in the competitive industry would increase from $3.5a$ to $3.75a$ while marginal return would increase from $2a$ to $2.5a$. At the same time average resource return is raised in the competitive industry, it would be lowered in the monopoly industry, with intersector comparability in resource returns brought about from change in both directions. There would be no pure profit in the competitive industry, its gross return being just equal to the quantity of resources multiplied by their market value. In contrast, the monopoly industry would have in the original situation, based on the profit equation of (5.32), a net or monopoly profit of $2.25a^2$, gross revenue exceeding the value of resources by this amount, with resources rewarded at the aggregate market rate.

We have examined a second set of economic phenomena which may cause resource employment to be large and returns to be low in an industry of pure competition, such as agriculture. Clearly the relatively lower returns and large employment of resources in the competitive sector under equations (5.27) and (5.29) are not due to low supply elasticity of resources in the competitive sector. For the equilibrium resource price of $3.5a$ and total resource quantity of $6a$, with return lower in the competitive sector, supply elasticity computed from (5.29) is 2.33, denoting a 2.33 percent change in quantity supplied for a 1 percent change in resource price. Accordingly, it is necessary that the possible role of industry organization be analyzed along with factor supply elasticity, in our attempt to explain the quantity and returns of resources in a competitive industry such as agriculture. Before we do so, however, we may ask whether, under mixed economic organization including both monopoly and competitive industries, transformation of the competitive industry into one of monopoly would solve the problem of resource return and input magnitude.

Returning to the example in equations (5.22) through (5.29), with an industry at each extreme of organization, we have this outcome. Transformation of the competitive industry to monopoly would give rise to two industries, each with the resource demand function in (5.26). The total resource demand then would be (5.33).

$$X_t = 20a - 4P_x \tag{5.33}$$

When equated with the factor supply equation, the resulting equilibrium price for factor is $3.125a$, an amount smaller than under-mixed organization because many fewer resources are employed. Total resource employment, with both industries organized as monopolies, is $7.5a$ with $3.75a$ in each industry. The industry marginal value product of resources is $3.125a$, now higher than originally ($2a$) for the otherwise competitive industry, but lower for the original monopoly industry. The average return per unit of resource, 4.06, is higher than the original quantity of $3.5a$ for the competitive industry and lower than the original $4.25a$ for the initial monopoly industry. There are, of course, fewer resources employed at this average return rate, $1.5a$ or 16.7 percent less. If we are concerned with total product, and aggregate the products of the two industries on equal basis, the original product under mixed organization is

$45a$, while it is $37.5a$ where both are organized as monopoly. Hence, an appropriate question is: Would the initial problem of relative resource employment and return in the two industries be better solved by converting the monopoly sector to competition, rather than the opposite? Converting both to competition would give average revenue of $3.5a$ to all resource units and result in $50a$ of total product. If, of course, it is impossible to convert the monopoly industry to competition, or if doing so brings about instability and firms too small for progress, the decision might then be otherwise.

We discussed an example where factor supply had high "own" price elasticity, mainly to show that level of resource employment and return also can present a problem even where factor quantity responds readily to price. Let us now examine the opposite, the same form of demand function where elasticity is at the other extreme as X_s in Figure 5.1. We again suppose two industries with identical demand curves for their products and with identical production functions. The marginal and average value productivities of resources for each industry are respectively X_m and X_c in Figure 5.1. In this case X_m is the demand function for resources by a monopoly industry; X_c is the demand curve under competition. We might suppose the factor to represent a resource such as labor which is largely fixed in short-run quantity and whose price is flexible.

If one industry is organized as monopoly and the other as competitive, total factor demand is X_1 (mixed organization), with employment at ox_2 in the monopoly industry and ox_4 in competitive industry. Average resource return is ov_4 in the former and ov_2 in the latter. Transformation of both to competition will expand total factor demand to X_2 (all industries competitive), with employment increasing to ox_3 in the previously monopolistic industry and decreasing to ox_3 in the original competitive industry. Average return per unit of resources will decline from ov_4 to ov_3 in the former monopoly industry, but increase from ov_2 to ov_3 in the original competitive industry.

Transforming both industries to monopoly pricing and production policy provides a total resource demand function X_c (all industries monopoly), with ox_3 resources employed in each industry, the same allocation as if both were converted to competitive. The average revenue also will be ov_3 for both, the same level as if both were competitive. Similarly, the marginal value productivity of resources will be the same, ov_1, if both industries are competitive, the same as if both were monopoly. The average return of the original competitive industry will be raised from ov_2 to ov_3 level, by converting all industries to either competition or monopoly. Similarly, resources employed in the original competitive industry will decline from ox_4 to ox_3 regardless of whether all industries are converted to pure monopoly or to pure competition. While the marginal value productivity of resources is ov_0 for the competitive industry under mixed organization, it rises to ov_1 under monopoly or competitive organization of all industries.

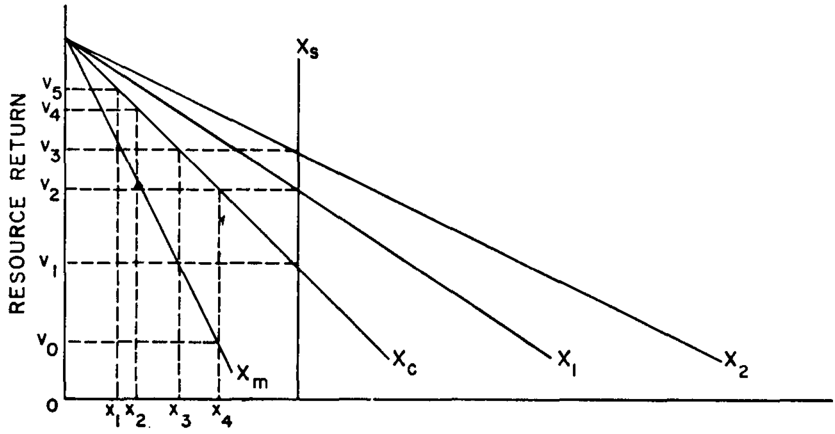

Fig. 5.1. Relation of Industry Organization to Resource Employment and Return.

Clearly, in the case of inelastic resource supplies as perhaps for labor in the short run, an allocation more consistent with consumer preference, as indicated by equality of marginal and average resource returns among industries, can be created by transforming a mixed industry organization into one of either pure competition or pure monopoly. The aggregate product would be equal under the two extremes of all monopoly or all competition, and larger than with mixed competition and monopoly. In mixed organization, marginal value productivity is ov_0 for the competitive industry but at ov_2 level for the monopoly industry. Under complete monopoly or complete competition for both industries, it is at ov_1 level for both, denoting a maximum aggregate product with full employment of resources. If one group of persons owned resources and another or different group purchased them, a major difference would still exist. Under mixed organization, resource return or price is ov_2, while it is only ov_1 under complete monopoly but at the higher level of ov_3 under complete competition.

Resource supplies do not in general fall in either of the elasticity categories discussed above. Some are highly elastic and others are of low elasticity in the short run. Even labor supply has elasticity in the short run, although the peculiar institutional and sociological attachments cause the short-run elasticity to differ greatly among industries and among sectors of agriculture. The low elasticity of farm labor supply, to the industry relative to magnitude of demand for labor in farming, has little impact on supply elasticity for a labor sector where employment opportunity is highly restricted to union membership; but the low elasticity in the union sector, protected from outside supply, could have important impact in causing supply to remain large and of low elasticity in sectors of competitive labor.

Monopoly and Imperfect Competition Extent

With industry organization a possible explanation of why resource supply may be large and return may be low in a competitive industry, the environment needs to be reviewed as it surrounds agriculture. To what extent does monopoly prevail in the American economy, either in commodity firms or organizations such as labor unions selling resources, and affect quantity and returns of factors in agriculture? We have already noted that other major industries do not conduct their pricing and production policies in the vein of the pure competition model which is the mode of agriculture. This is true even for industries which sell resources to agriculture, which are not single monopoly firms but are more nearly of oligopoly structure, with a few large firms and entirely different methods of commodity and resource pricing than in agriculture. When demand slackens or supply increases in agriculture, commodity price immediately declines. But under these same conditions during the recessions of the 1950's, the price of fertilizer, farm machinery and other resources outside of agriculture generally did not decline as producing capacity and supplies pushed against demand. Instead, prices were maintained, and sometimes increased, while output was curtailed. Firms did not "in general break out of the flock," producing more and selling it at a lower price. Certainly, competition generally does exist in such industries, but not in respect to short-run price in the extent of agriculture. Competition perhaps is more in (1) gaining share of the market at a general schedule of prices, although the price line is not easily or always held, (2) in developing new products and new technology and (3) other activities of the latter nature which do lead to progress. Galbraith perhaps would suggest that the level of affluence of American society might well lessen urgency to produce more and allow some luxury of monopolistic-bent pricing and production policy, to provide greater security and stability.[3]

There is not firm agreement on extent of monopoly in U.S. economy. A few studies have suggested that it does not prevail widely. Other persons claim that it is of important magnitude. Harberger suggests, as measured by magnitude of profit, the extent and importance is not large.[4] The data he explores are quite aged, the extent of monopoly influence being subject to increase with time, or to curtailment with federal antitrust action. Too, existence of monopoly is not adequately measured by profit or rate of return, where the latter may be capitalized into resources or facilities, the apparency of pure profit then disappearing in income statements and balance sheets.

Using profit rate on equity as one indication of degree of monopoly, Bain presents the figures in Table 5.5.[5] Agriculture has the lowest return,

[3] J. K. Galbraith, *The Affluent Society*, Houghton Mifflin Co., Boston, 1958, pp. 127–32.

[4] Arnold C. Harberger, "Monopoly and Resource Allocation," *Amer. Econ. Rev.*, Vol. 44.

[5] Joe S. Bain, *Industrial Organization*, John Wiley and Sons, New York, 1959, pp. 384–85. He points out (Chap. 10) the chronic maladjustment in unconcentrated, excessively competitive industries such as agriculture.

TABLE 5.5

AVERAGE PROFIT IN EQUITY FOR SELECTED SECTORS IN 1953

Sector	Average Profit Rate (After Tax)
Finance	10.1
Manufacturing	8.1
Construction	7.8
Services	5.9
Wholesale and retail trade	5.7
Public utilities	5.1
Mining and quarrying	4.5
Agriculture, fisheries and forestry	2.9

as would be expected for a competitive industry surrounded by monopoly sectors. However, we must also recognize that low factor supply elasticity for particular industries also can contribute to similar disparities in profit rate. Such broad sectors, of course, aggregate some unlike products and industry organizations. Using smaller aggregates, Bain found the 1953 profit rate to be 12.9 for motor vehicles and equipment, 10.9 for electrical equipment, 9.5 for chemicals and 8.7 for tobacco manufacture. For the four largest firms in particular sectors, over the period 1947–51, he found profit rate of 23.9 for automobiles, 18.6 for distilled liquor, 15.8 for soap, 12.6 for cigarettes, 11.2 for steel, 9.8 for canned goods and 5.1 for meat packing.

Kaysen and Turner examine industrial structure in terms of oligopolistic markets, with oligopolies defined to have a market share of sufficient magnitude to cause interaction between behavior of individual firms.[6] They conclude that structural oligopoly is the numerically dominant form of market organization in manufacturing. Heflebower expresses the belief that competition outweighs monopoly by a wide margin in the American economy, citing as evidence that the economy is large enough so several firms and industries can operate at maximum efficiency, competition exists between firms due to rivalry of managers, and public opinion is unfriendly to monopoly.[7] He does not, however, provide empirical evidence of his own.

The degree of market concentration and the trend is suggested in summary Table 5.6 from the Report of the Subcommittee on Anti-Trust and Monopoly.[8] That output control is sufficient to give important degree of stability and certainty in price for important sectors of the economy is suggested when only 200 firms account for 37 percent of total value added in all manufacture. To this can be added the ability of even smaller

[6] C. Kaysen and D. F. Turner, *Antitrust Policy*, Harvard University Press, Cambridge, Mass., 1958, Chap. 2.

[7] R. B. Heflebower and G. W. Stocking, *Readings in Industrial Organization and Public Policy*, Richard D. Irwin, Inc., Homewood, Ill., 1958.

[8] United States Senate, 85th Cong., 1st Sess., 1957. "Concentration in American Industry," Report of the Subcommittee on Anti-Trust and Monopoly to the Committee on the Judiciary, p. 11.

TABLE 5.6

SHARE OF TOTAL VALUE ADDED BY MANUFACTURE ACCOUNTED FOR BY LARGEST MANUFACTURING COMPANIES IN 1954 COMPARED TO THOSE IN 1947

Company Rankings in Respective Year	1954	1947
Largest 50 companies	23	17
Largest 100 companies	30	23
Largest 150 companies	34	27
Largest 200 companies	37	30

firms, when a few represent the majority of a sector, to serve effectively in price determination.

Nutter stated the extent of monopoly to be inconclusive to 1939.[9] His criterion was based on a concentration ratio of .5 or larger by the four largest firms in particular industries. His estimates showed 21 percent of national income in 1937 produced by monopoly industries, using the definition above. However, for particular industries, he found 100 percent of anthracite mining to be produced by monopolistic groups. The comparable figures were 64 percent for metal mining, 68 percent for rubber products, 37 percent for iron and steel, 93 percent for transportation equipment, 34 percent for chemical and 39 percent for miscellaneous products. His figures also showed 78.2 percent of value of manufactured products to be produced by the largest 10 percent of establishments in 1939. For the same year he uses Stigler's estimates, indicating 55 percent of income to be produced under competitive conditions and 24 percent under monopoly conditions.[10] For the same year, Stigler estimated 28.7 million persons to be employed under competitive industry, 1.4 million under compulsory cartel, 7.4 million under monopoly and 8.5 million under nonallocable industry. The relative employment of labor in these various categories may be more significant for agricultural supply than proportion of national income produced by monopoly industries.

Galbraith implies the major price-making forces, as well as important elements leading to technical progress, to rest in monopoly or oligopoly industries. His figures indicate that in 1947 the largest three producers accounted for two-thirds or more of the output in motor vehicles, farm machinery, tires, cigarettes, aluminum, liquor, meat products, tin containers and office machinery. The largest six accounted for two-thirds of volume in steel, glass, industrial chemicals and dairy products. He looks upon the negative outcome of monopoly power to be less a shortage of product and extreme of price and to be more that of excessive employ-

[9] G. W. Nutter, *The Extent of Enterprise Monopoly in the United States, 1899–1939, A Quantitative Study of Some Aspects of Monopoly,* University of Chicago Press, Chicago, 1951.

[10] G. J. Stigler, *Five Lectures on Economic Problems,* the London School of Economics and Political Science, The Macmillan Co., New York, 1950.

ment in competitive industries.[11] He also emphasizes the social concerns of mixed economic organization in a wealthy society to be less that of inefficiency of production and more that of inequality of income distribution, with the extreme fortunes of leading families having come from monopolistic industries such as oil, steel and copper and never from competitive industries such as agriculture.

MONOPOLY IN LABOR MARKETS

Sufficient monopoly in sectors of the labor markets would also strain the supply of labor in agriculture, causing it to back up on farms and produce a larger product for the market and at a lower return for itself. It is known, of course, that extreme cases of monopoly unions exist, with great featherbedding to spread supported wage levels to more labor resources which qualify under the restraints of entry to the union or craft. Yet monopoly in labor supplying by unions itself cannot have a dominating effect in backing labor up on farms. Too many persons migrated from farms from 1940 to 1960 for this to have been a deterrent of significant effect. During major spans of the period, even more could have migrated geographically and occupationally to receive greater resource returns than in farming. Other off-farm factors, such as information, housing and schools, probably were restraints more than was lack of nonfarm job opportunity; and these were probably less important than particular attachment to agriculture or knowledge lacks, in holding labor in agriculture. Also, an important portion of the U.S. labor force is not unionized, with farm labor having equal footing in these sectors. Finally, scattered empirical data available suggest that migrants from farms find, upon entry to the nonfarm labor force, employment equal or comparable to persons of nonfarm origin with the same skills and abilities.[12]

Exclusion for opportunity in nonfarm job opportunity is important in isolated areas in maintaining a surplus of labor in agriculture. It is most important in respect to Negro labor. Even here, a substitute for nonfarm employment in the community is the same at a different location where the similar institutional restrictions do not apply (but obviously one of a higher monetary and knowledge cost in transfer). In this sense, widespread existence of intensive pure-type monopoly is prevented by the presence of many substitutes, just as in the case of products where one fuel, metal or transportation method is a substitute for another, or where products of foreign producers serve as substitutes preventing the classbook terrors of monopoly (although foreign products do not use surplus labor from competitive industries in the U.S.).

Undoubtedly the monopoly power of unions acts as some restraint to the migration from agriculture, particularly in movement to specific in-

[11] J. K. Galbraith, *American Capitalism*, Houghton Mifflin Co., Boston, 1956, pp. 103–4 and Chap. 7.

[12] D. Gale Johnson, "Functioning of the Labor Market," *Jour. Farm Econ.*, Vol. 33.

dustries. However, empirical evidence which exists is too meager and inconclusive for quantitative statements. Union restrictions are most important during periods when some unemployment persists, as in the period following 1957, and less important in periods of full employment and labor scarcity. The latter characterized much of the decade following World War II and probably caused monopoly power of unions to be ineffective in restraining migration from farms. Still, with an important degree of chronic unemployment, such as that arising after 1957, union restrictions and seniority restraints became much more effective in excluding farm labor from opportunity. With surplus of labor, and that from other sectors having the first claim, farm labor is more nearly pushed to the point of "taking the second-best," or of obtaining employment only after "first claimants." While it may have return as high as others of the class where it does obtain employment, it can be greatly excluded from other employment sectors of higher return.

But with the array outlined above, U.S. industry is not competitive in the sense of agriculture's pure model, the latter being entirely a "price taker" with no ability to restrict output to an established price. Not even the corner druggists in the farm town are thus. Neither is U.S. industry monopolistic in sufficient extent to stifle progress, diminish national product to important degree and cause extreme poverty for the masses.

Noncompetition in respect to short-run price does not, as we have pointed out previously, mean lack of competition. Competition is sufficient in other respects to generate progress. As Galbraith has suggested, countervailing power and economic progress has prevented negative-sum outcome to the national community. Perhaps, too, as he suggests, the visible effects of monopoly on efficiency are negligible, given the opulence of the American economy. If resources were allocated more efficiently throughout the economy, through reduction of monopoly power, and given the exotic nature of the product mix which has already been attained, the outcome would be more zippers for cigarette packages and larger tail fins, although certainly the nation has important missions and goals which could absorb added manpower and capital. But even more of these could, of course, provide added employment opportunities for surplus labor from agriculture or other competitive industry. Or, given the mixed industry organization of the U.S. economy, economic growth of sufficient magnitude would still provide employment opportunity for labor released from agriculture.

With the present organizational mix projected into the future, reemployment of surplus labor from agriculture depends almost entirely on economic growth. This is likely the dominant prospect and stands to be more important than elimination of monopoly structure in allowing labor released from agriculture to be absorbed in other economic sectors.[13]

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[13] For further discussion and bibliography relating to monopoly power and industry organization, see R. B. Heflebower and G. W. Stocking (eds.), *Readings in Industrial Organization and Public Policy*, Richard D. Irwin, Inc., Homewood, Ill., 1958.

While an important portion of production capacity often goes underutilized, in adjustment of monopolized industries to a given demand and price potential, general underemployment has been, at least until recent years, more a short-lived function of recession than of monopoly expanse. Even in the existence of some monopoly, or noncompetitive industry organization, economic growth in post World War II years generally was ample to absorb labor migrating from farms. The relatively large percentage of unemployment maintained after the 1957 recession, however, is burdensome particularly for an industry such as agriculture which has to send out part of its labor force.

The crucial questions of monopoly and managed production and prices in respect to agriculture perhaps are less the effect of the latter in backing labor up on farms, thus causing returns to be low, but more this: To what extent should and can the managed policies of other industries be used in agriculture, to put it on the same control footing as major nonfarm sectors, to convert an industry of pure competition and low demand elasticities to greater stability, to solve its basic capacity problems and to provide means in equity whereby it can retain some positive share of gains from its contribution to economic progress? We come back to these points in a later chapter. Even if agriculture is to gain market or bargaining power as in other industries, which model will be used: the pure monopoly model, the steel industry, telephone communication, grocery stores, the textile industry or drugs? None of these are pure competition, but they differ greatly in their monopoly extent.[14]

Even if it were certain that monopoly industry dominated other industries and caused labor of low return to back up importantly in farming, an attack on industry monopoly to solve the farm problem would have little prospect of success. Why? Because it is unlikely that agriculturally oriented policy could gain the strength and momentum to upset and change the industry organization of the dominating sectors of the economy and convert them all to pure competition. Agriculture doesn't have this amount of political strength. Other industries probably would rather subsidize agriculture than have their organizational structure upset to solve farm ills.

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[14] For some concepts and other indications of monopoly and competition, see E. S. Mason, *Economic Concentration and the Monopoly Problem*, Harvard University Press, Cambridge, Mass., 1957; M. A. Adelman, *A and P: A Study in Price-Cost Behavior and Public Policy*, Harvard University Press, Cambridge, Mass., 1959; A. D. H. Kaplan *et al.*, *Pricing in Big Business*, Brookings Institute, Washington, D.C., 1958; J. Downie, *The Competitive Process*, Duckworth, London, 1958; S. M. Loescher, *Collusion in the Cement Industry*, Harvard University Press, Cambridge, Mass., 1959; J. W. Markham, *The Fertilizer Industry*, Vanderbilt University Press, Nashville, Tenn., 1958. Also, for suggestion of competition over "monopolistic" industries, see J. A. Schumpeter, *Capitalism, Socialism and Democracy*, Harper & Brothers, New York, 1947, pp. 84–85. He indicates that the important competition involves new technology and new products even in "less competitive" industries.

CAUSES OF VARYING FACTOR SUPPLY ELASTICITY

Having examined an "outside force" with possible effect on size of and return to farm labor, we now return to the "inside forces." Low factor supply elasticity does not cause low resource returns and prices under every circumstance. When demand increases faster than farm technology, low factor supply elasticity causes premium returns to resources. Instances in less developed countries where supply of capital and technical knowledge are of low elasticity have typically led to high real prices of food and high prices for borrowed capital and land. Under the sudden demand bursts attached to war, similar circumstances have surrounded U.S. agriculture. Its supply being inelastic, land has had a much greater, or a sharp increase in, return imputed to it during these periods, with resulting inflation of values such as occurred following World Wars I and II. Return and price of capital items of low supply elasticity, such as secondhand farm machinery, also increased greatly, often above the controlled price of new items. These spurts in returns provided capital gain in land and other assets, improving the equity position of farmers and the base for more new technology and farm size expansion.[15]

The variables important in causing depression of farm prices, incomes and resource returns, during a normal period of favorable national economic growth and rising real incomes of the nonfarm population, are not alone those relating to the supply elasticity of resources such as land and labor or capital in dollar value. Even where resources have low elasticity in the short run, their return can be maintained or increased if improvement in productivity is held in check against increase in demand. The problem of agriculture over the last century, with returns below those of nonfarm sectors, has been caused partly by high birth rates. Labor born in agriculture has always had to migrate, even at times when employment in agriculture was increasing. But once the rate of technical advance becomes accelerated, with the productivity of resources growing more rapidly than demand for them in agriculture, the situation is aggravated. Under these circumstances, with rapid increase in substitutability of capital for labor, not only does surplus farm labor need to migrate, but also total employment must decline if returns are to be maintained. The historic tendency of labor to hang back in agriculture thus gives an exodus too small to draw returns in agriculture nearer levels of the nonfarm economy, particularly when the rate of technological improvement exceeds growth in food demand.

Low supply elasticity for some factors would be unimportant in causing lag of returns if it were not true that elasticity of other resources is

[15] Land values, after the great postwar demand burst had eased and the supply of capital items became more elastic for substitution with land, were importantly supported as operators with capital gains bid for land to expand their units. With the high fixed costs representing modern machine technology, acreage added typically had greater net marginal value productivity than that already owned. This phenomenon, plus the emerging structure of agriculture based on technology and factor prices favoring specialization and substitution of machinery for labor, greatly increased capital requirements, at the very time commodity prices became depressed and general resource returns declined.

high. As emphasized several times herein, returns to resources of inelastic supply could actually grow with population and food demand if the rate of technological improvement were sufficiently restrained, or of sufficiently low elasticity in supply. Quite obviously, then, high supply elasticity and low price of knowledge representing technical improvement, taken as a resource along with the new forms of capital it represents, causes a problem to grow as reflected in rapid technological change and low short-run supply elasticity of land, labor and capital resources committed in form to earlier technologies. The high supply elasticity of one set of resources, knowledge and the capital forms it represents, causes problems to stem especially from the low supply elasticity of other resources (and the tardy rates at which they adjust to changes in the production function and price relatives).

Conceptually and factually, it is easy to illustrate how increase in supply elasticity, or decrease in supply price, of some factors may depress returns to resources of inelastic supply. Using an extreme case for illustration, we use the commodity demand function in (5.1) with the elasticity $e = .2$ and the industry production function in (5.14). (See footnote discussion for equations 1.1–1.5) Further, for the extreme illustration, we suppose that price elasticities of supply are zero for Z factor but nonzero for X. Expressing commodity price from (5.1) as a function of Q, substituting the value of Q from (5.14) into this equation and multiplying by the marginal physical products of (5.14), the marginal value products of resources represented by Z and X respectively are (5.34) and (5.35). We have substituted the values in (5.36) and (5.37)[16] into the original equations or marginal value productivities in expressing (5.34) and (5.35), since Z is fixed in magnitude along with price and productivity parameters.

(5.34) $$MVP_z = K_1 X^{-1.6}$$

(5.35) $$MVP_x = K_2 X^{-2.6}$$

(5.36) $$K_1 = .4c^5 r^{-4} Z^{-2.6}$$

(5.37) $$K_2 = .4c^5 r^{-4} Z^{-1.6}$$

With the factor supply equation in (5.38), the factor "supply price" equation is (5.39). Equating factor price in (5.39) and marginal value productivity in (5.35) for X factor in a competitive industry, the static equilibrium demand quantity for the variable resource is (5.40) where the terms making up K_2 dominate w.

(5.38) $$X = wP_x^s$$

(5.39) $$P_x = w^{-1/s} X^{1/s}$$

(5.40) $$X = (w^{1/s} K_2)^{s/(1+2.6s)}$$

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[16] In other words, $P = c^5 Q^{-5} = c^5 r^{-5} Z^{-2} X^{-2}$ where $e = .2$ in (5.1) defining magnitude of commodity price in terms of inputs. The marginal value product $P \cdot (\partial Q / \partial X_i)$, using X as

$$MVP_x = (c^5 r^{-5} Z^{-2} X^{-2})(.4 r Z^{.4} X^{-.6})$$

Obviously, if the price elasticity of factor supply, s, is increased in magnitude, input of X also will be increased as indicated by (5.40), but for our particular function in asymptotic limit. Substituting the magnitude of X in (5.40) into the marginal value productivity of Z in (5.34), the latter can be expressed as (5.41).

$$(5.41) \quad MVP_z = K_1(w^{1/s}K_2)^{-1.6/(1+2.6s)} = K_1(w^{1/s}K_2)^{-s/(.625+1.625s)}$$

Hence, it is obvious that an increase in supply elasticity, s, for X will reduce the marginal value productivity of Z if the latter remains fixed in quantity.[17] Obviously, too, if supply price of X is reduced by increase in magnitude of w, factor supply elasticity remaining fixed, magnitude of X also will increase and marginal value productivity of Z resource, in its fixed magnitude, will decline. As a general case for any form of functions, industry total revenue will always decline with increase in price elasticity and reduction in supply price for X and greater use of this factor with Z at fixed value and with a price elasticity of demand for the commodity of less than 1.0. Net return in total to the industry and per unit of Z will always decline where price elasticity of demand for X is greater than 1.0, a condition depending on the magnitude of parameters in the production function, and increased expenditures on this factor results. It also will decrease if the decline in industry total revenue is greater than reduction in expenditure on X, where supply price of the latter declines but its price elasticity of demand is less than 1.0.

Again, with the marginal productivity of Z resource of magnitude in (5.34) or (5.41), its marginal value productivity, or even net return per unit, can be restored to original magnitude (or other level) by decreasing the quantity of this input, as already illustrated for change in the production function relative to Table 5.1 and as being forced on U.S. agriculture by the pressures of the market. But as explained previously, the rate of decline in labor and land devoted to particular commodities in agriculture has not been sufficient to maintain level of return in the market, or even in the presence of price supports.

DIFFERENTIAL STRATA OF AGRICULTURE

Changes in technology and supply price of resources need not reduce, or change in similar directions and magnitudes, the income of all strata of farms and farm resources, even where reduced income is the outcome for the industry and price elasticity of demand for food in aggregate is inelastic. On a first possible category of exception are a few commodities with high price and income elasticities of demand, where change in demand and technology at particular rates may allow increase in net sector income and resource returns. Falling most nearly in this category are commodities of greatest exotic nature, such as selected fruits and vegetables. The regions best described by these conditions largely are favored

[17] The value of $-s(.625+1.625s)^{-1}$ increases absolutely with s, but towards the limit mentioned previously. The value of wK_2 raised to this power will also increase. However, since wK_2 is in the denominator, the marginal value productivity of Z will decline as value assigned to s increases.

by unique climate or soil conditions which limit the growing area and restrain the supply function accordingly. Localities of the Southwest and Southeast suited to crops such as artichokes, lemons and similar products are examples, although means (e.g. market orders) other than the free market and magnitude of unique soil and climatic inputs are sometimes necessary (or used) to hold gains of technical advances in agriculture and input industries for growers.

A second category of conditions allows some farmers to gain while others sacrifice in income as supply price of commodity declines under inelastic demand. If some strata increase output by a greater percentage than the decline in commodity price, their revenue will increase, as that for the industry and for strata which increase output by a smaller percentage than the decline in price diminishes. This possibility can be illustrated simply by supposing the industry demand function in (5.42) where Q_d is quantity of commodity and P is price. We also have two strata of farms, each originally with the supply function in (5.43). Summing supply for the two strata, the industry supply is (5.44).

$$Q_d = a - cP \tag{5.42}$$

$$S_i = .75cP - .1a \tag{5.43}$$

$$S_t = 1.5cP - .2a \tag{5.44}$$

Now equating demand (5.42) and total supply (5.44) and solving for P, we obtain the static equilibrium price in (5.45). Output of each stratum is (5.46) and revenue to each is (5.47).

$$P = .48ac^{-1} \tag{5.45}$$

$$Q_i = .26a \tag{5.46}$$

$$R_i = .1248a^2c^{-1} \tag{5.47}$$

Now suppose that supply for the first stratum changes to (5.48), through technical advance or a more favorable price for a resource such as capital, while that for the second stratum changes to (5.49). The second stratum realizes greater productivity gains from technical change or more favorable prices for factors than the first stratum. The total supply function now is (5.50) and the new static equilibrium price is (5.51).

$$S_1 = .9cP - .12a \tag{5.48}$$

$$S_2 = 1.05cP - .14a \tag{5.49}$$

$$S_t' = 1.95cP - .26a \tag{5.50}$$

$$P' = .4278ac^{-1} \tag{5.51}$$

$$Q_1 = .265a \tag{5.52}$$

$$Q_2 = .3092a \tag{5.53}$$

$$R_1 = .1135a^2c^{-1} \tag{5.54}$$

$$R_2 = .1323a^2c^{-1} \tag{5.55}$$

Outputs of the two strata are (5.52) and (5.53). Revenue for the stratum with the smaller change in supply function declines from (5.47) to (5.54) while revenue for the other stratum increases from (5.47) to (5.55). Technical change and supply increase have been realized by both stratum, but one gains and the other sacrifices in revenue because of differential rate of change. While total revenue for the industry, including both sectors, decreases, revenue of the second stratum is improved. Changes in net income among groups generally will be in the same directions as for gross revenue, although it will be modified by the resource demand elasticity of each stratum.

A third category of conditions, similar to that presented above, also can allow return to the industry to decline, while some strata gain and others sacrifice in income. This is the case where one stratum cannot expand output because of lack of resources. For example, suppose that our first stratum of farms has output restrained to $.25a$ because of capital limitations while the second stratum originally has the supply function in (5.43). Industry supply is (5.56), and with demand in (5.42), static equilibrium price is $.4857ac^{-1}$. Revenue of the first stratum, with $.25a$ output, is $.1214a^2c^{-1}$.

$$S_T = .75cP + .15a \tag{5.56}$$

$$S_T' = 1.05cP + .11a \tag{5.57}$$

Revenue for the second stratum, with $.2643a$ output, is $.1284a^2c^{-1}$. Now if the supply function of the second changes to (5.49) and output of the first remains at $.25a$, due to lack of resources, total supply becomes (5.57) and equilibrium price falls to $.4341ac^{-1}$. Revenue of the first stratum, with $.25a$ output, will decline to $.1085a^2c^{-1}$ while that for the second stratum, with $.3158a$ output, will increase to $.1371a^2c^{-1}$.

Economic development in an industry of inelastic commodity demand and factors of low elasticity need not, then, cause all producers to sacrifice. Some strata may gain, along with society in general, from development while the sacrifice of advance falls more intensely on a smaller group. This differential impact on income applies among groups which are separated by both geographic region and capital availability. Public and private actions which increase the supply elasticity or lower the supply price of resources such as knowledge and capital items do not apply equally to all groups. This gives rise to major policy issues, with groups sacrificing from aggregate change often expressing preference for policy differing from those who gain from the over-all change. More particularly it gives rise to, or need for, policies which redress the costs of some as others gain from progress, or for framework which better guarantees positive-sum utility outcomes where progress rewards in the market are not distributed symmetrically.

The same differential income outcome applies similarly among commodities where the cross elasticities of demand are sufficiently large (i.e., the commodities are "close" substitutes in consumption or in further production) and supply function for one commodity is lowered more than for another. Since the same general outcome applies among substitute commodities, policy conflict again tends to arise. Wheat producers favor control programs and are willing to restrict wheat output if they can shift resources to grain sorghums, and corn farmers required to restrict corn output are willing to do so if they can shift to wheat or beans, etc. Even if grain output did increase slightly under control mechanisms, one group of farmers who can increase output greatly can gain at the sacrifice of those who are more restrained by control mechanisms. This complex has generally led to control programs which have an escape route among substitute commodities for resources freed from particular commodities in the various regions, with the result that aggregate output is affected but little.

RESOURCES OF HIGH SHORT-RUN SUPPLY AND DEMAND ELASTICITY

The important capital resources of elastic supply which substitute for labor and land of low short-run elasticity are largely new machinery, chemicals for fertilizer and pest control and biological forms which represent new varieties and breeds and improved nutrition. If their supply price is kept low, incentive for substitution is great and will cause the rewards to factors with low supply elasticity to continue in depressed state. This depression of income will occur, of course, only if the aggregate supply function shifts rapidly relative to the demand function. Even with substitutes, the short-term rewards to labor and land would still increase if growth rate for demand was sufficiently greater than aggregate commodity supply. The prices of these "more variable" capital items have been kept low since 1940, causing continuous pressure on labor and land except as cushioned by temporary demand spurt and support prices, evidently because the degree of competition and the extent of technological research within industries furnishing inputs to agriculture have been sufficiently great.

In addition to the evidence contained in Table 2.10, Figure 5.2a illustrates how an important input, fertilizer, has maintained a favorable price relative to crop prices since 1940. During the sharper break in farm price depressions, due to the structure of pure competition in agriculture, and a smaller degree of competition in the fertilizer industry as expressed in price constancy, the price of fertilizer rose relative to crop prices. The industry structure of the cluster of firms making up the fertilizer sector does not provide the same short-run price flexibility as farm prices do under recession and demand curtailment. The structure of pricing in the chemical industry has not been one of *pure competition*.[18] Yet *competition* since 1940 *has been sufficient* to keep fertilizer prices low

[18] For a discussion of anti-trust legislation relative to the fertilizer industry, see J. W. Markham, *The Fertilizer Industry*, Vanderbilt University Press, Nashville, Tenn. 1958.

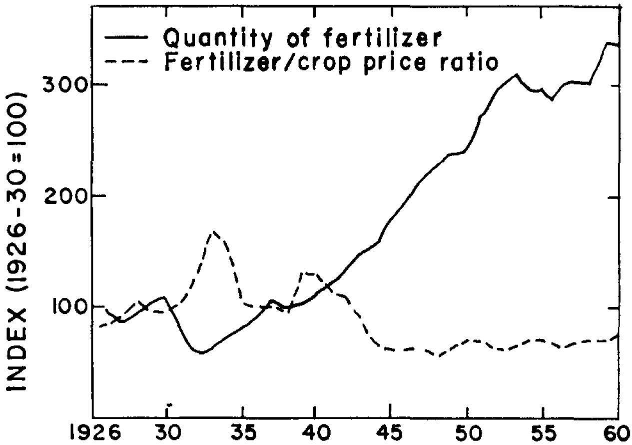

Fig. 5.2a. Total Demand or Use of Fertilizer and Fertilizer/Crop Price Ratio. U.S. 1926–30 = 100.

relative to farm product prices. Fertilizer prices not only have been kept at low real level because of sufficient competition, although not of the pure type with prices breaking sharply when demand slackens relative to capacity (fertilizer prices have sometimes increased after farm demand for fertilizer declines following reduced farm income), but also because of technological developments relating to the manufacture and analysis of fertilizer.

Increasingly, as capital items come to dominate agricultural inputs, research in and relative to the input-furnishing industries has importance in changing commodity supply in agriculture. Decline in the real supply price of farm capital items would not, of course, result in the use of (the demand for) new technology if the supply of knowledge were not also great. As mentioned previously, the level of supply price for both of these technical complements is important in farm development. It is not possible, even in the case of fertilizer where quantities are more readily quantified, to separate the proportion of increase in fertilizer demand or use which can be attributed to either (1) the relative pricing or (2) knowledge increase since 1930. Both scientists and farmers know more about fertilizer productivity than they did at that time. But ability to quantify the effect of knowledge supply on response currently cannot be extended much beyond the general magnitude in equation (5.58).

$$\begin{aligned} \log Y_t = 10.677 - \underset{(.201)}{.490} \log X_1 + \underset{(.054)}{.637} \log X_2 - \underset{(.615)}{1.082} \log X_3 \\ + \underset{(.022)}{.076} \log X_4 \end{aligned} \tag{5.58}$$

In this demand equation from our Iowa study, predicted for the period 1926–56, Y_t refers to U.S. fertilizer use in the current year, X_1 is the

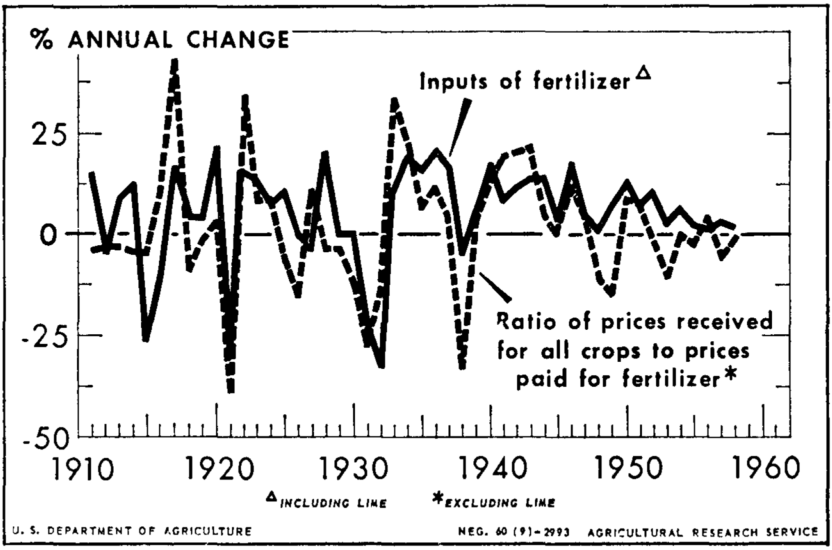

Fig. 5.2. Percent Annual Change in Commercial Fertilizer Inputs and Relative Prices. U.S 1910–60.

fertilizer/crop price ratio at planting time, X_2 is gross cash receipts from farming in the previous year, X_3 is total acreage of cropland and X_4 is time. This equation, with a coefficient of determination of .99 (standard errors in parentheses below regression coefficients), uses X_4 as a "gross measure" of knowledge (and other variables related to it) in expressing the effect of time on use of the fertilizer resource. The elasticity of the fertilizer/crop price ratio in this short-run equation is $-.49$; indicating both (1) the quantitative effect of a decline in the real price of fertilizer and (2) that farmers are short-run price responsive in the use of resources whose supply is not fixed to agriculture.[19] This same short-run responsiveness is illustrated in Figure 5.2.

The situation is similar for other new capital forms where the degree of competition and technical research in the input industry, applying both to processing of a resource and in predicting the productivity effect, keeps the real price of the factor low and more of it is "demanded," as a substitute for other resources. Hybrid corn, improved seeds generally and other capital items have been similarly priced at favorable levels relative to farm product prices. Of course, the price ratio is only one magnitude expected to cause greater use of a resource with elastic supply.

[19] A corresponding long-run model applied to the same data is (5.59) where the lagged value of fertilizer demand is used to predict short-run and long-run elasticities.

$$\log Y = 2.602 - \underset{(.246)}{.352} \log X_1 + \underset{(.048)}{.094} \log X_4 + \underset{(.164)}{.715} \log Y_{t-1} \tag{5.59}$$

This equation, with an R^2 of .95, predicts a short-run elasticity of fertilizer use in respect to the fertilizer/crop price ratio of $-.35$. The comparable long-run elasticity computed from the equation is -1.23.

Its productivity is equally important, and research, both by the private and public sectors, has caused these magnitudes, or knowledge surrounding them, to grow.

As mentioned before, input firms and industries can be expected to extend research at both levels, that related to the processing of inputs keeping their supply price favorable and that related to productivity of inputs on farms, both leading to expansion in demand for resources of nonfarm origin. Since agriculture uses a small proportion of the nation's capital, these inputs can continue to be furnished to agriculture with high degree of supply elasticity. Agriculture's relative magnitude alone will not give rise to increasing costs in industries of chemicals, steel and drugs. This setting, along with the pure competition structure of agriculture, is indeed conducive to continued economic development in the farm industry. Given the level of demand and its inelastic nature for major farm products, however, this complex is not likely to lead to greater total revenue of the agricultural industry, except as brought forth by general inflation, a condition wherein real income of agriculture may still decline.

The net effect of high supply elasticity for capital items representing new technology and tendency of real price of these resources to remain low is to allow physical productivity of land and labor in agriculture to increase, thereby reducing the amount of either required to produce conventional products at the rate of demand growth being experienced. To the extent that the pricing mechanism is used to promote economic development and allocate resources, this complex leads to reduced returns for resources which come into surplus relative to consumer preferences. The important policy questions, then, supposing the pricing mechanism to be the major gauge for intra-sector resource allocation and continued economic development, are these: How can the pricing mechanism or its equivalent be used to suggest or implement the change implied by economic growth without causing owners of surplus resources to bear unreasonably the gross social costs of change? Can extra-market mechanisms be used equitably to bring compensation to these resource owners while still allowing net social gains from economic development? Or, can market mechanisms be modified to allow simultaneous accomplishment of these two goals in sufficient degree?

Capital Substitution and Prices for Land and Labor

As productivity of capital items representing new technology is predicted, the demand function for them generally moves to the right, even where they are used for commodities of inelastic demand. Reduction in their real supply price also causes increase in their use. The individual farmer does not directly substitute items such as fertilizer and improved strains for land and labor; he simply uses more of them with a given input of land and labor, although he may substitute machinery for labor under favorable price and productivity ratios. In aggregate, however, a given quantity of food can be produced with less labor and land as new technology is used to increase output per unit of land, feed or animal. In an economy dominated entirely by competition and the market, these technological advances would cause labor, and especially land used at the margin of profitability, to shift more rapidly, but still with lag, to other uses as the commodity supply function shifts more rapidly than demand.

Policy mechanisms which support prices at previous levels tend to retard this reallocation, especially for land. Land prices since World War II have increased, seemingly a contradiction to part of the above analysis. A large portion of this increase came, however, in the period when foreign demand was greater and resource productivity was somewhat smaller.[20] In the absence of price support and public storage programs, a realignment of land prices would take place. Under the forces of the free market the problem of "comparable resource returns" largely would be solved by a reduction in land values, plus some further migration of labor.

Whereas farmers in aggregate have received a lower return on their capital investment than nonfarm industry, if market wage rates are imputed to labor, the return generally would be as high—if land values were reduced. For example, disregarding scale economies possible from expansion, a farmer with 200 acres priced at $200 and with net of $6 per acre, after expenses and imputation of market return to labor and other capital, will realize 3 percent on land investment. (This level of return, or lower, has been typical on many farms even under price supports, and would be even more widespread in the absence of price supports.) If, however, land prices were to decline to $100 per acre, the same investment would support 400 acres. The return of $6 per acre, supposing scale economies offset addition of some nonfamily labor, would amount to 6 percent on investment, a level more nearly comparable with industrial investment. Hence, we have a second major "market specified mechanism" for remedying the problem of rate of return in agriculture. The first "market specified mechanism" was: increase the supply elasticity of particular resources to agriculture with emphasis on labor. The second "market specified mechanism," like the first, has psychological and economic blocks for particular persons and groups.

While a decline in land prices, accompanying freer markets for commodities and decline in their price level, would help solve the "rate of return problem" in the manner illustrated above, it would still require a

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[20] Prices continued to move up because of the cost economies of modern machine technology and specialization, the net marginal value productivity of land for farm size expansion being greater than for the original unit, as noted earlier. Too, for individual operators, capital items representing new technology serve in a complementary manner with land, although the two serve as substitutes in the aggregate. The potential gain to the industrial operator from improved seed or fertilizer is limited to the number of acres under operation. By adding more acres, he can realize more gain from new technologies. Finally, inflation and price support policies have maintained levels of land price in the face of surpluses and depressed income for particular commodity sectors.

capital loss for landowners. If a farmer could withdraw his investment before decline from the $200 price and hold it for reinvestment after decline to the $100 per acre price, capital loss would be averted. This procedure is impossible, of course, on a net basis. Accordingly, farmers do not recommend it as desired policy. An alternative policy mechanism which might serve as the equivalent, requiring smaller public investment than an infinite time span of subsidies in price supports and commodity storage, would be public compensation to offset decline in resource values. In the above examples, compensation of $100 per acre, to cover the capital loss, would allow the farmer to expand acreage to 400. Still a "catch" arises. One could expand only if another withdrew from agriture, and agreement among farmers in respect to "who should stay and who should leave" would not be easy. The answer to this conflict is not given among industrial firms who, not always competing on a quoted price basis, use ingenuity in a competitive attempt to expand at sacrifice to each other for a given demand quantity.

The "market specified mechanism" would cause the aggregate substitution of capital in new technology for land to be more fully and quickly realized. Under policy mechanisms of the last several decades, land clings fairly well to its conventional uses, with new technology used on it and the growing surplus channeled into public storage. Under the free market, however, that at the margin would gradually shrink away from its conventional farm uses, being replaced by the capital of new technology used on land of greater comparative advantage remaining in production.

This substitution of technology capital for land and labor is one of the social gains of economic development. Had not the resources of auto and plane production been allowed to substitute for those of buggy and trains, or the public power line for the kerosene lamp, farmers and other consumers would now find life less convenient. In fact, aside from the characteristics of pure competition and public investment in development, the major problems of agriculture have been widely experienced in other industries. Resources for farm machinery replaced those of harness producers, and even blacksmiths. Petroleum and other energy sources have substituted for labor and capital specialized to coal production. The technology and capital investment adapted to supermarkets caused the neighborhood grocery to be replaced, much in the vein that modern technology and capital requirements in farming bring fewer firms, a different spatial concentration of firms and the displacement of particular labor and building resources.

As a single sector, agriculture does represent more persons and resources than other distinct industries. But the aggregate of change and substitution in several industries has involved as many resources and persons as that of agriculture. Why, then, is specific public policy to cushion change and modify its effects of greater importance for agriculture than for aggregates of industry? Or, alternatively, if policies to modify the social costs of change are important for agriculture, why are they not equally relevant for other sectors? Agriculture and other sectors have had somewhat similar mechanisms to lessen income losses from change growing out of economic development. Labor displaced by technological change in nonfarm industry has had unemployment compensation to help bridge the income gap *in shifts among occupations.* Agriculture has had support prices to lessen the income burden, but only for resources *which remain in agriculture.* Mechanisms for both sectors lessen the pain to the individual of adjustment to technological change, but the mechanisms for agriculture are much less consistent with economic development. The mechanisms which provide cushion of unemployment are not intermixed with the mechanisms possessed by labor, a sector which otherwise would be as competitive as agriculture, to provide stability and bargaining power. Policy to provide stability in farming is curiously mixed with that which might be termed compensation for the sacrifices which fall on agriculture as a result of its contribution to economic progress.

BASIS OF LOW FACTOR SUPPLY ELASTICITY

In the scheme of impersonal economic analysis, large supply and low price for farm commodities and low returns of resources can be attributed to the low supply elasticity of certain factors. If these resources flowed more rapidly from agriculture, the marginal productivity of those remaining would be enlarged. Resource return would be increased especially if reduction in inputs lowered commodity output in magnitude to raise price sufficiently. But without reduction in output, or even with small increase, the average return of human effort would be increased greatly by migration of many more persons with low capital and income. The average would be raised through the simple mechanics of arithmetic: division of the product among fewer laborers. It also would increase the amount of capital per remaining person, allowing fuller and more complete use of much underemployed labor. By the same arithmetic, net income per farm would increase if low income families left agriculture, even with their resources remaining idle.

Manipulation of resources to raise averages and margins is a simple process for inanimate resources. They have no personal feelings in respect to which are withdrawn or which are left. To raise the average and marginal product of fertilizer, the process is simple: withdraw some units of fertilizer from each acre, the particular units being of no concern. The labor return and family income problem is not so simply solved because "it does matter" to these resources. Most farmers actively engaged in the occupation would like to stay, a psychological factor which goes a long way in explaining why short-run labor supply elasticity is low to agriculture, at least in relation to rates of change in commodity demand and technology.

LABOR MOBILITY

Supply elasticity is highly synonymous with factor mobility, especially for labor. Farm labor has been mobile, with the number of workers declining by nearly half since 1920. But decline in number of workers underestimates the real extent that labor has shifted from agriculture. This is true since it does not reflect the great increase in farm persons employed part or full time in other industries. Mobility has not been small in absolute terms, but only relative to the magnitude of change in technology and supply capacity of agriculture. Even with large absolute reduction, farm labor has been in surplus because the rate of technical advance has been much more rapid than the rate of demand growth.

We need to explore, then, not so much why agricultural labor has lacked mobility, but why it has not been more mobile. One important reason has already been mentioned: the attachment of a person or consumer to the labor unit. But the consumer is guided in preferences and flexibility by other quantities we must examine. In a sense, the question is one of why a certain stratum of the farm population has low mobility relative to change around it. Mobility varies greatly among geographic, age and income strata of farmers. As Figure 5.3 indicates, migration is highest in the 15 to 25 age group, representing those first entering the labor force. It is lowest in the 30 to 49 age group, representing those who are actively engaged in farm operation, and next lowest in the 25 to 29 and 50 to 54 groups. This selectivity in migration has shifted a greater proportion of the farm population into the age group beyond 45 and under 15 years. Consequently, the potential in mobility rate at conventional level of income and wage variables would be expected to decline if the shift

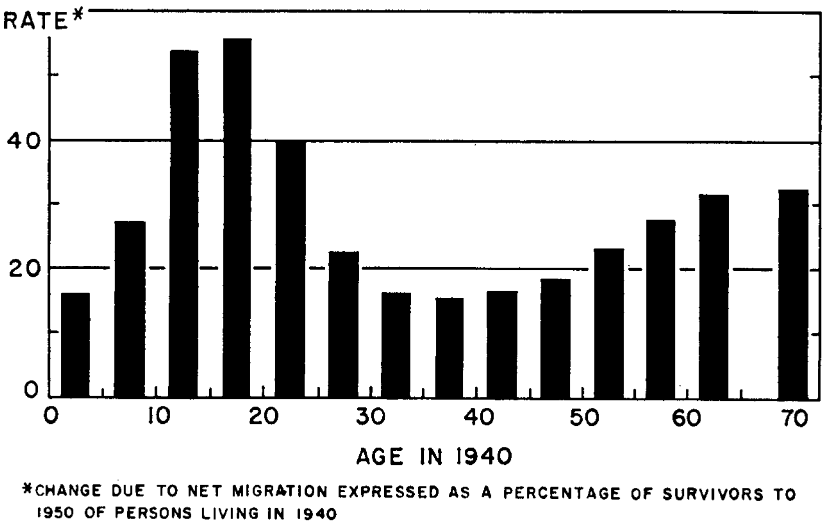

Fig. 5.3. Net Migration From Farms, U.S. 1920–58. (Source: A.M.S.)

continued long enough. However, the relative shift of population to older groups itself serves to reduce the size of the farm labor force more rapidly. Fewer young persons are attached to farming to enter the industry and a greater proportion of laborers are retiring.

The migration of nonwhite labor has been greater than for whites, a likely function of income level, amounting to 42.2 per 1,000 population for the former and 28.8 for the latter in the decade 1940–50.[21] Bowles found the migration rate to be as high as 36.9 in extremely low income areas, as compared to 28.0 for medium and high income areas. Further increase in migration rates for those groups highest in the past is needed particularly to increase their own economic outlook and opportunity. It is needed for young persons so that more will have a greater income potential under economic growth. It is needed for nonwhite and low income families particularly where their resources and outlook in farming are meager and their incomes could be raised substantially from nonfarm employment. Yet these groups produce only a small fraction of the total farm product and their basic land resources could be operated by many fewer remaining operators. Hence, the migration rate within these groups could be considerably greater without causing material reduction in the commercial farm problem as it is conventionally defined for basic commodities. Large outmigration of low income and nonwhite operators in the mountain areas and Southeast would not solve the problems of surpluses in wheat and feed grains, just as supply control for the latter would not solve the poverty problems of the former.

A considerable step-up in migration rates would be needed to close the gap between farm and nonfarm labor earnings. The large outmigration over the last several decades did not close the relative income gap. Farm persons have realized about the same proportionate gain in real income per capita as the nonfarm population as an average over the period since 1945. But the relative gap has been maintained, indicating that it was necessary for farm labor to decline almost a third to hold its own in a relative sense. Too, real income of agriculture declined in the 1950's. This rate of outmigration might well continue in the 1960's and 1970's with agriculture only holding its own in respect to per capita income. To be sure, its absolute income would increase, but per capita farm income as a percent of nonfarm might well remain at current levels. Johnson estimates that this could be possible, with farm labor declining by as much as 35 percent in the period 1956–75, without improvement in the relative return per capita.[22] The possible offsetting forces would be slow-down in rate of technical advance or large increase in foreign demand. Without these modifications, a deep bite in the labor force of commercial farms, beyond that needed to improve economic outlook of young and low in-

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[21] Gladys K. Bowles, *Farm Population—Net Migration From the Rural Farm Population, 1940–50*, AMS Stat. Bul. No. 176, Washington, D.C., 1956.

[22] D. Gale Johnson, "Labor Mobility and Agricultural Adjustment," *In* Earl O. Heady *et al.* (eds.), *Agricultural Adjustment Problems in a Growing Economy*, Iowa State University Press, Ames, 1956.

come persons, would be needed in the next decade if labor returns were to be boosted to the comparable nonfarm level solely through the market mechanism. As a step in gauging these possibilities it is useful to examine variables which cause supply elasticity of labor in farming to be low relatively.

Anticipation and Communication

As mentioned previously, migration rate is lowest for established farm operators. They are experienced in the occupation, generally have values oriented to a rural community and generally have preferences for remaining in agriculture. Partly, however, this preference arises because of expectations in respect to the farm industry and lack of sufficient knowledge about economic growth and its relation to agriculture.

In respect to expectations, established farmers up to the 1950's have known that agriculture, as other industries, "has its ups and downs in economic conditions." In their limited knowledge, depression of income was only temporary, as it had always been in the past, with eventual restoration to some normal level. Agricultural economists led them to the firm belief, during the last major depression, that solution of the farm problem rested on full employment. The war and postwar period seemed to confirm this proposition. Then as temporary demand melted away, the illusion disappeared. National and per capita income grew to record levels, but farm income declined and continued in depressed state.

Still farmers knew so little of structural relationships, both in agriculture and the national economy, that many held to the belief that "improved economic weather will be back as soon as the demand drouth is over." But why should they know otherwise? This generally had been true during periods of "ups and downs" for their fathers and grandfathers. Then, too, their educational institutions did not provide them with knowledge of basic economic structure, even though knowledge of structure and intersectional outlook was crucial information to them in planning such important matters as future of their children and their own occupational directions and investment. They were provided information of fertilizer response, next year's hog prices, new varieties and similar important physical and economic data. But the meaning and magnitude of income elasticities of demand were not explained to them generally. Neither were they instructed in the relative premiums and penalties which attach to different industries through economic growth. While slight improvements have been made in this situation, it still predominates. Extension programs have been mercifully weak in presenting the broad picture of economic structure to farmers. Farmers and their children have suffered in income and opportunity accordingly, even though hogs and hens have been better off because of the intensive education devoted to improvement of their menus and housing. Certainly more farmers would have shifted resources to other occupations had economic structure been communicated more effectively to them. Even more would have altered plans in respect to on-farm investments.

Inflexibility and Location of Skills

Flexibility in the human resource is greatest before it has been committed to an occupation, as is reflected in mobility rates among age groups. Dip in income of resources owned by middle-aged operators can be considerable before they are convinced to change occupations. The response is indeed one of distributed lag pattern, of the general nature illustrated in Chapter 4. Partly, they have persisted in farming under hopes and expectations that "things will improve," but also because it takes time for reorientation of plans and values. Farmers generally have established preferences for their occupation, tied as it is to a particular type of community and method of living. Also, while the inherent abilities of a 48-year-old Kansas wheat farmer and an electronics worker in Massachusetts may be equal, their skills are no longer so. Even if the Kansas wheat farmer is realizing only $2500 for his labor, he is not likely to receive the return of the electronics worker if he shifts occupations. Not only do his skills become less flexible with time but also his personal preference and value orientation become highly fixed. The complex provides a much greater obstacle to occupational migration than for the skilled worker who may shift readily to another industry as it provides greater return. Not only are the latter's skills more easily transferred, but also he continues to live in a community of the type to which he is accustomed, even if he moves across the nation. With high outmigration by young people, the major component of low labor supply elasticity to agriculture is in the age groups representing established farmers. Since labor in farm operation, for the individual entrepreneur, is complementary with capital and land, the latter resources remain with him in low out-response to depressed returns.

Flexibility in human capacities and value orientations could be higher than at the present, although it has been growing with economic development and increased communication. However, a society truly pressed in scarcity of resources, and extremely concerned about welfare of persons with depressed incomes, would find means of increasing flexibility of skills and elasticity of factor supply to particular industries. Not only would it gather up the steel in obsolete and surplus farm machines and forge it into other tools; it also would provide equivalent facilities, in adult education and redirection of skills, for agricultural labor.

Market Communication of Occupational Outlook and Resource Returns

The free market does not work perfectly in reflecting expectation of prices to all producers and resource owners. It serves best for the market of a particular day at a particular location. It is less perfect in reflecting price and return at a future time and distant location. To help overcome these imperfections, the USDA and land-grant colleges established outlook services for commodities. These aids have been useful to farmers in planning use of their resources on farms. They have been developed to the extent that if a sow could read the morning paper, she could learn her worth at Chicago or Denver. Similarly, a calf on the ranges of Wyoming could acquire expectations of his worth as a vealer next month or as a bull four years hence. But a farm boy has not been provided equal facilities for acquiring expectations of his worth in different occupations and locations. This is true even though no commodities produced in agriculture have greater social importance than persons.

These historic imperfections of the market in reflecting price outlook of resources in various occupations and locations have been extremely important in causing resources to remain in agriculture at lower return than in other occupations. The burden falls more on agriculture than other industries because of the tendency of agriculture to be geographically separated from other occupations and to concentrate in restricted communities. Lipset found, in his analysis of social mobility in California, that the smaller the community of orientation, the greater the chance that the person would spend his career in manual occupations.[23] With larger community orientation, the status of the job and upward mobility increased.

While a variety of manufacturing and service industries exist side-by-side in most industrial complexes of the nation, agriculture typically is not geographically mixed with nonfarm occupations. This separation of markets has impact on both farm youth and operators who have already committed resources to agriculture. Youth groups in school have greater occupational homogeneity and less opportunity to learn about alternative employments and returns from their companions. In the same vein and for the same reason, schools in rural communities have provided much less in the way of vocational guidance and counseling. Because of pure knowledge lack, the farm youth has had a lower reservation price to the occupation in which he was born than his city counterpart.[24]

But this is also true of the established farm operators. Because of the geographical separation of farm and industrial concentration, he is poorly informed both of the existence of employment alternatives and of the rate of resource remuneration. Even the newpaper he reads seldom has a page of advertisements for labor in different industries, as is true for his city counterpart, because it has a particular geographic and occupational focus. The worker or businessman in the industrial complex is generally much better acquainted with developments in other fields about him, partly because he is not separated from them in the same geographic and informational sense. The geography itself presents a psychological barrier. Reynolds found that shift "to the unknown" and breaking ties with friends and relatives served to restrict occupational mobility of urban

[23] S. M. Lipset, "Social Mobility and Urbanization," *Rural Soc.*, Vol. 20.

[24] C. N. Hamilton ("Educational Selectivity of Migration From Rural to Urban Communities," *Amer. Soc. Proc.*, 1960) found migration to be greatest among the most highly educated farm youth and lowest among those who completed only eight grades.

workers.[25] These factors would be expected to serve more strongly in agriculture where the changed cultural environment must be added to these shift obstacles.

This informational void is not lacking for on-the-spot commodity prices of agriculture. Major commodity exchanges exist to reflect the value of wheat, cotton and similar resources to every part of the country. They do so not only in averages but in specific and refined grades of these commodities and resources. The USDA and land-grant colleges invest in further defining these grades so that refinement and detail are extended. Market communication of comparable refinement and geographic and quality coverage of the agricultural commodity exchanges does not extend to the basic resources of agriculture. If comparable market information were developed for human resources, geographic isolation would much less keep the supply elasticity and reservation price of labor to agriculture at such low levels. It is this communication void, rather than industrialization per se, which causes the extremes in lag of adjustment in agriculture to economic development. Schultz attributes the differential adjustment of agricultural resources and income to what he terms "locational matrices," with these being oriented to industrial-urban development.[26]

Quite obviously, nations with rapid economic development have advanced far in income beyond those experiencing only meager progress. The result could not be otherwise. But in respect to rate of adaptation of agricultural communities, to generate higher farm incomes and higher resource returns, location in respect to industrialization is only a superficial relation. The important and basic variables are those related to communication of market quantities and conditions for resources. They are also those relating to investment in social overhead capital, with its effect on knowledge, skills and mobility of people. It is true that if a large industrial plant is located in an isolated farming area in South Dakota, farm labor and resources nearest the plant will adjust to the new employment opportunity more quickly and completely than those more distant. But this need not be true. The adaptation of wheat resources, to the growing of the commodity or the time of the marketing of the raw material, does not vary between locations in Kansas nearer or further from the central markets and processing centers. Similarity exists in the adaptation of these wheat resources relating not to location, but to communication of market information and investments to effect their transfer as readily at one as the other location. It is not the location, in orientation of a resource or commodity to a particular price or income, but the degree of perfection in market reflection which does so.

One can find illustrations of more rapid and complete adaptations of

[25] L. G. Reynolds, *Structure of Labor Markets*, Harper and Brothers, New York, 1951, pp. 76–112.

[26] T. W. Schultz, "Reflections on Poverty Within Agriculture," *Jour. Farm Econ.*, Vol. 33.

TABLE 5.7

PERCENT CHANGE IN FARM POPULATION AND EMPLOYMENT BY DECADES
(ALL FIGURES REPRESENT DECLINE UNLESS OTHERWISE INDICATED)

Region	Farm Population					Farm Employment				
	1920–30	1930–40	1940–50	1950–60	1920–60	1920–30	1930–40	1940–50	1950–60	1920–60
New England	4.2	+ 8.4	20.7	12.6	31.8	10.0	13.0	23.8	14.0	48.7
Mid Atlantic	10.1	+ 4.4	10.4	7.5	22.2	16.1	1.7	13.8	29.6	50.0
East North Central	9.1	+ 3.0	11.8	8.5	24.4	16.3	1.8	12.7	11.4	36.4
West North Central	2.4	7.3	16.9	18.4	38.7	4.1	13.3	5.5	20.1	37.2
South Atlantic	9.0	+ 2.5	16.6	15.2	34.0	11.7	8.7	19.1	25.3	51.3
East South Central	2.8	+ 3.4	18.3	19.4	33.8	2.2	16.7	15.8	39.6	58.6
West South Central	+ .6	5.3	32.3	24.5	51.4	3.2	25.7	25.9	18.4	26.5
Mountain	3.1	2.2	17.1	16.6	34.4	+ .9	13.5	13.7	16.6	37.2
Pacific	+11.1	+10.2	2.6	3.0	+15.6	+11.1	+ 7.1	.8	5.1	+12.1
U.S.	4.5	+ .1	18.0	15.5	33.8	7.0	12.1	14.9	22.0	45.7

Source: *Agricultural Marketing Service.*]

farm resources to development along a particular vector of a locational matrix; but equally, the variance to this structure exists, with greater adaptation of resource use and returns in regions distant from centers of industrialization than in areas of closer attachment. The difference either way is to be explained in income, communication and market reflection rather than in location. Market communication is more fundamental than location, per se. In some cases other variables are fundamental to communication. Income and phenomena surrounding it, such as schools and travel, explain why some pockets of labor in agriculture are ill-informed and less mobile in respect to job opportunities.[27] In other cases, lowness of income in agriculture itself has encouraged exodus regardless of vector in the locational matrix.

Expressing differential relating to this more complete structure during the decade 1940–50, the farm population declined 35 percent in North Dakota, 38 percent in Montana and 43 percent in Oklahoma. These are states without industrial development of important magnitude and great distance to the "industrial matrices" of the nation. The decline was only 15 percent in Pennsylvania where per capita commercial farm incomes averaged less than for the states cited above and industrial concentration is much greater. It was much lower than for these Plains states in areas of the Southeast where industrial development has been substantially greater and farm incomes are lower. While the groupings in Table 5.7 are too aggregative for reflection of important detail and difference, they do indicate rates of migration and labor reduction which have been especially high in areas distant from urban development centers and in areas of lowest farm income. (Also see Figure 12.1.)

In a more restricted geographic comparison and along a different comparative vein in economic development, we find higher labor returns in farming in north central Iowa than in parts of southern Iowa closer to industrial areas such as Des Moines or St. Louis. We find higher labor

[27] Gladys Bowles (*Farm Population and Migration From Rural Farm Population*, AMS Stat. Bul. 176) shows that the rate of migration from low income areas is about a fifth greater than that for agriculture as a whole.

returns on wheat farms in northeast Colorado or in Montana than for farms near a rapidly growing industrial complex in North Carolina. For example, in 1959 the average value of real estate per farm was around \$65,000 in Phillips County, Colorado, a county without industrial development and of considerable distance from major industrial center. The value of products produced per farm laborer approached \$10,000. In contrast, Paulding County, Georgia, had a per farm value of real estate of around \$6,000. The value of product produced per farm laborer was around \$600. Yet Paulding County falls in locational orientation and proximity to a rapidly developing industrial complex. The farm population of these two counties declined by nearly equal proportions from 1920 to 1959. The locational matrix per se fails to explain the greater degree of farm development and income in Phillips County as compared to Paulding County. These contrasts in agricultural adjustment and development stem more from mobility characteristics relating to farm income and market communication than to particular locational matrices related to industrialization. The same is true for the higher rate of development of farms in upper Illinois near industrial development as compared to those of western Arkansas which are more distant from development.[28]

The exact cause and extent of poverty or degree of economic development cannot be traced to a single original cause. As Myrdal points out, it is perhaps useless to look for one predominant explanation.[29] Still, if we were pressed for one, we would indicate it as lack of a community's ability to invest in the necessary social overhead capital, developing the characteristics of human resources which allow them to adjust to employment opportunities wherever they exist in the economy.

While the South lacks resources to make this investment on scale of other regions, this has not always been true. Even at earlier times when it possessed more wealth and development per head, it did not invest in the social overhead capital necessary to produce attributes of human resources for the purpose under discussion. This was true in comparison with newer regions of the West which were purely agriculture and with little commerce and which did invest more heavily in social overhead capital. Douglas C. North indicates that the South showed but little concern for widespread education of both whites and nonwhites before 1860, even though it had relatively more resources for this purpose than newly developed regions.[30] The complex of human opportunity and return cer-

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[28] Also see Gladys Bowles ("Migration Patterns of Rural Farm Population," *Rural Soc.*, Vol. 22) for added explanations of migration patterns over geographic areas. For differences among regions, she emphasizes level of fertility, productivity of farming and farm income level, etc. Finally, the relation of demand and supply in labor rather than space and locational matrix per se, becomes important in the manner outlined by W. E. Hendrix, "Income Improvements in Low-Income Areas," *Jour. Farm. Econ.*, Vol. 41, pp. 1072–73.

[29] Gunnar Myrdal, *Rich Lands and Poor*, Harper and Brothers, New York, 1953.

[30] Douglas C. North, *Economic History of the United States to 1860*, Prentice-Hall, New York, 1961.

tainly revolves around this type of investment more than any other thing, although wealthier and more industrialized communities can best afford the investment. Quoting from North, we believe the following to explain much of the difference in human productivity and mobility outlined above.[31]

> Investment in human capital in the South was conspicuously lower than the other two regions. The ratio of pupils to white population in 1840 was 5.72 percent . . . compared to 18.41 percent in the non-slave holding states. . . . Even more significant were the attitudes of the dominant planter class, who could see little return to them in investment in human capital. . . . To educate the large percentage of white Southerners who were outside the plantation system was something they vigorously opposed. . . . The attitude of the West towards investment in skills, training and education led to an early willingness of Westerners to devote tax money for education and training . . . tax money devoted to public education all show a great difference of the West over the South. The Westerner looked upon education as a capital investment with a high rate of return . . . invested heavily in spreading skills, knowledge and technology. . . .

Capital for Transfer

The cost of transfer among locations is lower within an urban complex which includes a variety of industries and services than in transfer from farming at one location to nonfarm employment several hundred or a thousand miles distant. Accordingly, reservation price of industrial labor in one industry is near the return of competing industries which use similar labor at the same location. True, the cost of bus transportation, or gasoline for a cheap auto, is of small magnitude for long-distance travel. Without other commitments and investments, this relatively low direct cost allows great mobility among young persons and raises their reservation price and supply elasticity to agriculture. The real costs of transfer are considerably greater, however, for an established farmer with family commitments and farm investment. Liquidation of assets requires period of income loss for farms built around dairying or other fairly stable commodity flow. The period required for employment and housing contacts, and the living attached to it, also boosts costs for this group. In the sense of expectations and uncertainty, knowledge lack also results in a greater degree of discounting of possible returns at other locations and in other employment, as compared to the young or urban worker. We are moving, however, to a time when lack of capital and funds is much less a deterrrent to mobility than lack of market knowledge and skill flexibility. For many farm families in the poverty class, however, it is still an obstacle of magnitude equal to communication void.

Education and Training

No larger occupational group has had immobility forced on it through educational facilities as much as has agriculture. Not only are educational facilities generally of lowest quality in rural communities but also they have been oriented towards turning farm children back into agriculture. Vocational agricultural training has dominated in rural communities,

[31] *Ibid.*, pp. 133 and 155.

often being the only type of vocation training offered aside from home economics. As stated before, investment in occupational guidance also has been smallest in rural communities. Auxiliary educational and guidance facilities have supposed farm youth to be unique agricultural resources to be driven back into the industry to produce more farm products. Extension youth and 4-H efforts had this as their near single focus up to recent times, and in most states this is still true. (See the allocations of vocational education funds indicated in Chapter 13.) These concentrations have tended to help hold the supply elasticity of labor to agriculture at relatively low levels, although farm youth have increasingly been saved from extreme oversupply to agriculture because of the growing mass of communication stemming from economic development. Study by the Freedmans emphasizes the effect of education which tends to turn youth back into the same occupation.[32] They found that farm-reared youths are over-represented in low status position, whether status is measured in occupation or income. The farm reared generally held low-status jobs and received low incomes, the findings applying regardless of sex, color or region of residence. (Also see Table 13.1.)

Many rural communities do not have the resources for education and guidance facilities which will produce labor resources of quality and skill to mesh with opportunity in growing nonfarm industries of other states. It is unfortunate that the individual community has so long been expected to do so. The public in other states and locations make investments for improved agricultural resource use (e.g. research on new crop varieties, fertilizer response, etc.) in a particular agricultural county, in order that consumers in distant urban centers will gain from price, quantity and quality of farm commodity. Mechanisms to accomplish the same improvement and flexibility in the human product of agriculture also exist and are no more "unworldly," whether they be obtained by state and federal aid to schools or by other means.

Miscellaneous Attachments

Numerous other phenomena cause labor to remain attached to agriculture and receive income lower than in alternative occupations. Historically, the higher birth rate on farms than in cities has caused a large labor supply oriented to agriculture. Origin of large quantities of labor in agriculture is not per se a reason why its supply elasticity and reservation price to the industry should be low enough to cause depressed resource returns. However, it is only this fact in connection with the variables mentioned previously which causes the situation to prevail. Combine high birth rates with low incomes, inadequate education, lack of market information, inverse vocational guidance and lack of alternative economic opportunity and insufficient investment in social overhead generally, however, and the supply situation will be intensified. The

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[32] Ronald and Deborah Freedman, "Farm Boy in the City," In *Principles of Sociology*, Henry Holt, New York, 1956.

opposite of these conditions and high birth rates are not a basic cause of low factor supply elasticity, large commodity output and low product and resource prices in any industry.

Difference in living costs in farm and city occupations provides a basis for difference in money income, but not in real income. The persistent intersector gap in money income cannot be explained fully by difference in price of consumer goods and services. Analysis by Koffsky and Reid suggests that purchasing power of farm and nonfarm income has important gaps even when price and tax differentials are considered.[33] Johnson suggests that per capita money income of farm people equal to around 70 percent of that of nonfarm people is necessary to give equal real income to comparable labor. This takes into consideration price differentials and composition of labor force by sex, age, capacity and dependency.[34]

The data of Table 2.4 indicate that important increase in per capita farm income is still necessary to provide comparable real income. Indirectly and somewhat remotely, we must also attribute some degree of low mobility and elasticity of farm labor supply to low elasticity of credit and capital to agriculture. The supply of credit is highly elastic, up to a restraint based on the equity of the operator. Beyond this, response of capital supply to him is relatively low at high prices. This factor market condition has implication to labor supply especially in the low income and poverty sectors of agriculture. If capital supply were of higher elasticity over a greater credit range, more operators could expand farm size and improve income. Consequently, low income and inadequate communication and related restraints on mobility would be lessened for their children, and not infrequently for themselves. For some established operators, ejection would come as greater capital supply allowed others to expand and bid away their resources.

To some extent, but in much less degree than sometimes proposed, government compensation policies have held labor in agriculture in the extreme short run. Undoubtedly the positive empirical effect of these payments has been much less important than the quantitative effect of the small public investments in appropriate job communication, economic outlook, education and training and vocational guidance towards nonfarm development. As in tobacco, subsidies and control effects on income have been largely capitalized into land values. Return to a farmer with fewer acres and higher land values is not materially greater than it would be in the absence of extra-market policy and more acres at lower price per acre. On the large number of low-income farms, an increment of $100 to $200 from government programs is not the crucial factor

[33] N. Koffsky, "Farm and Urban Purchasing Power. Studies in Income and Wealth," Vol. 11, *Nat. Bur. Econ. Res.*, 1949. Also see discussion by Margaret Reid.

[34] D. Gale Johnson, "Labor Mobility and Agricultural Adjustment," *In* Earl O. Heady *et al.* (eds.), *Agricultural Adjustment Problems in a Growing Economy*, Iowa State University Press, Ames, 1958.

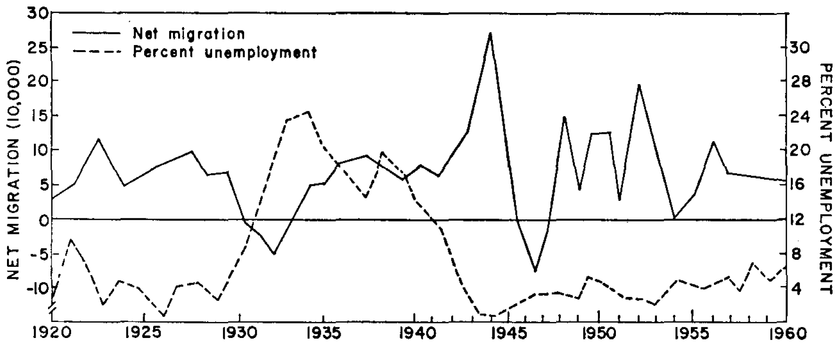

Fig. 5.4. Rate of Outmigration From the Farm Population, 1940–50. (Source: USDA.)

in holding labor of a family in agriculture, particularly youth entering the labor force, when the unit has income equal to less than half that of comparable nonfarm labor.

Subsidies cannot explain the century-long and world-wide persistence of labor remaining in agriculture to the extent that incomes have trailed other sectors. The years 1940–60 in the U.S., with out-movement being very great, provide no positive indication that farm subsidies have been an important long-run deterrent to migration from farms. Logically, one would expect the rate of migration to be a function of income disadvantage in agriculture and off-farm job opportunities. Indeed it is, particularly at extremes as suggested by the stoppage or great reduction in migration during depressions such as that of 1929 or recessions of magnitude in the 1950's. (See Figure 5.4.) Even during 1954, following the 1953–54 recession, net migration from agriculture dropped to zero. But with job opportunities, the level of farm income and the effect of subsidies therein appear to have had little effect. People have migrated more rapidly in periods of high farm income than in periods of lower income, given the opportunity of employment. (Lack of nonfarm employment opportunity does, of course, give a zero ratio of nonfarm to farm return.) Neither have values oriented to agriculture acted to deter farm youth. The majority evidently prefer urban life and migrate accordingly. At even labor returns, many would still do so, given current day communication and orientation towards urban life.[35]

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[35] See Larry Sjaastad, "Trends in Occupational Structure and Migration Patterns in the U.S." (Center for Agricultural and Economic Adjustment, *Labor Mobility*. Iowa State University, Nov., 1960). His regressions show magnitude of employment opportunity to be dominant over farm/nonfarm income ratio. Similarly, C. E. Bishop (same publication), found net migration to be positively regressed on level of farm prices, with farm prices and incomes also being positively correlated. His regressions also suggest a higher elasticity of migration with respect to nonfarm employment opportunity than with ratio of farm to nonfarm income of labor.

Supply and Demand of Farm Labor

Some quantitative indication of variables relating to U.S. farm labor supply is given by our Iowa study: in regression equations (5.60) estimated from original data in a two-equation, just-identified model, and (5.61), estimated as deviation from means by a single equation, the former for hired labor and the latter for family labor over the period 1929–57.

$$(5.60) \quad Y_h = 22.87 + .815Y_{t-1} + .176X_1 - .365X_2 - .104X_3$$

$$(5.61) \quad Y_f = \underset{(.136)}{.774Y_{t-1}} + \underset{(.059)}{.132X_1} - \underset{(.153)}{.405X_2} + \underset{(.078)}{.149Z_1} - \underset{(.103)}{.135Z_2}$$

While estimated by somewhat different technique and based on time series data which are not completely comparable, the relationships show, however, farm labor supply to be responsive with respect to price magnitudes within and outside agriculture.[36] For hired labor, the mean short-run supply elasticity in respect to farm wage rate is .13, the long-run supply elasticity being .71. The cross elasticity of hired labor supply with respect to nonfarm wage rate is predicted as .057 for the short run and .31 for the long run, all of these quantities being perhaps low for the future. While the results are not entirely comparable and the findings may have greater qualitative than quantitative importance, the family labor supply to agriculture shows positive response to magnitude of market labor return in agriculture and negative response to magnitude of nonfarm wage rate and percent unemployment.

The quantity of labor on farms also is a function of demand for this resource. Hence, we have estimated separate demand functions for hired and family labor. The U.S. demand function (5.62), estimated for hired labor over the period 1910–57, indicates demand for this resource to be responsive to changes in price of both labor and agricultural products.[37] Furthermore, the level of response of demand to a sustained price change was higher in the war and postwar period than in the depression period.

[36] For additional detail see Stanley Johnson, *Labor Supply and Demand in Agriculture*, Ph.D. thesis, Iowa State University, Ames. For both functions, labor supply is measured in millions and the variables have the meanings: Y_{t-1} is lagged magnitude of supply, X_1 is composite deflated farm wage rate, X_2 is time, X_3 is a composite nonfarm wage rate and employment indicator defined as $A(1\text{-}5U)$ where A is average wage rate and U is percent unemployment, Z_1 is a composite deflated nonfarm wage rate, Z_2 is percent unemployment. The figures in parentheses are standard errors. The hired labor equation was estimated by a simultaneous equation model and the family labor equation by a least-squares model.

[37] The demand function presented for hired labor and assumed to be the most efficient in estimation was a "simultaneously estimated autoregressive" least-squares equation with a distributed lag where: X_1 is the aggregate hired farm wage rate, X_2 is the index of prices received by farmers for all commodities, X_3 is time as a trend variable, X_4 is an aggregate value of farm machinery and equipment, and Y_{t-1} is the total number of hired farm workers lagged one year. The numbers below the regression coefficients in parentheses are the standard errors.

$$(5.62) \qquad Y = 116.3 - \underset{(.122)}{.341X_1} + \underset{(.112)}{.243X_2} - \underset{(.523)}{.687X_3} + \underset{(.195)}{.206Y_{t-1}}$$

These results indicate that hired farm labor demand response is related to the period of the business cycle. The estimated short-run price elasticity of demand for (5.62) is −.26. The computed long-run elasticity is −.32. Demand functions computed in our study for various census regions provide the elasticities in Table 5.8 for hired labor. These estimates, provided as means over the period 1910–57 by a distributed-lag regression model, indicate the elasticity of demand in respect to wage or price for hired labor resources to be considerably greater in the long run for all regions. Although there is some "tendency" for the elasticities to be highest in such "less industrialized" areas as the Cornbelt and Great Plains and in regions of lowest family incomes, we can make no probability statements about the pattern. The hired labor demand elasticities in respect to the parity ratio, prices received divided by prices paid, also are much greater in the long run. Among the regions for which we have computed the latter, no differential pattern can be expressed between short-run and long-run response. But the data clearly indicate a decline in demand for labor with an increase in its price and with a decrease in farm commodities relative to farm input costs. Empirical demand functions also were derived for family labor, both for the U.S. and by regions. The specification of the models was the same as that used for hired labor. Nationally, the regression results indicate a significant response in demand for family labor in relation to farm wage rate and farm income. However, "demand" is not unrelated to "supply" for family labor, and additional quantitative analysis is needed before differential effect of relative resource returns and farm commodity prices can be specified in demand for labor.

TABLE 5.8

ELASTICITIES OF DEMAND FOR HIRED FARM LABOR, 1929–57*

Region	Elasticities in Respect to Farm Wage Rate		Elasticities in Respect to the Parity Ratio	
	Short run	Long run	Short run	Long run
Northeast	−.05	−.17		
Mid Atlantic	−.19	−.75	.16	.64
East North Central	−.15	−.90		
West North Central	−.51	−.71	.36	.50
South Atlantic	−.12	−.32		
East South Central	−.35	−.82	.29	.68
West Central	−.26	−.67	.19	.50
Mountain	−.11	−.18		
Pacific	−.19	−.27		

* Functions for the West North Central and Mountain regions are for 1940–57. Those for the Pacific region are for 1947–57, a period too short to provide elasticities of comparability.

We have been discussing reasons why net migration and labor supply elasticity have not been greater—great enough to solve the farm price and resource income problem of agriculture. The analysis is in a relative sense to this magnitude of adjustment and not in terms of absolute migration. Numbers of persons migrating have been great relative to job opportunities on average, and in particular years. More persons would move if the job opportunities were closely available and they had this information. Certainly the elasticity of migration in respect to nonfarm returns is increasing. But it is not clearly apparent that migration can solve the capacity and commodity supply problems of commercial agriculture in the 1960's, except to the extent that capital losses of important magnitude are taken for land and more of this resource moves into less intensive uses such as forestry, grass and recreation. The degree of intensity, level of applying fertilizer and other technology inputs, is not likely to decline greatly at commodity prices of considerably lower level. This is true because many farmers do not use resources per acre at levels to equate marginal revenue and cost, as more large-scale operators with sufficient capital would do, and because the agricultural supply function so represented is based on a production function which has low elasticity in these reaches.

SHORT-RUN LAND SUPPLY FOR PARTICULAR USES

Land supply to agriculture is of much lower elasticity than labor supply. This is true because of its extreme lack of nonfarm employment opportunity. It responds readily to price stimuli in moving into urban and similar employment where the opportunity exists. This demand, however, is small relative to the total supply. More important to farm income and surplus problems is the magnitude of elasticity to particular farm uses, rather than to agriculture in aggregate. If land had shifted from corn, cotton and wheat to grass, trees and recreation as rapidly as knowledge and factor prices have allowed new technology capital to substitute for it, surpluses in these commodities would not have risen and their prices would have been higher, although prices of the alternative products would have been somewhat lower. Even if labor mobility were increased greatly, response of land would lag behind because of the tendency for remaining farmers to take it over and retain it in current uses.

Land in aggregate does respond to price stimuli in the longer run, even though the tendency of total plowland to persist at nearly 470 million acres for several decades would suggest other hypothesis. Yet if we examine land in farms and crops in regions such as New England and the Southeast, we do have evidence. In Table 5.9, for example, the long-run supply response of land to agriculture is suggested to be considerable for most of the states indicated. The magnitude implied is more nearly the cross elasticity of land for farms relative to the nonfarm price for land (or of land for farming relative to nonfarm return) rather than for

TABLE 5.9

LAND IN FARMS FOR SELECTED STATES AND REGIONS (1,000 ACRES)

State or Region	1900	1920	1940	1955
Masachusetts	3,147	2,494	1,938	1,439
Connecticut	2,312	1,899	1,512	1,138
New York	22,648	20,633	17,170	15,071
Pennsylvania	19,371	17,658	14,594	13,162
Virginia	19,908	18,561	16,445	14,686
West Virginia	10,655	9,570	8,909	7,352
North Carolina	22,749	20,022	18,845	18,260
Tennessee	20,342	19,511	18,493	17,654
New England	20,549	16,991	13,371	11,121
Mid Atlantic	44,860	40,573	33,639	29,898
South Atlantic	104,298	97,775	92,555	90,259

Source: U. S. Bureau of Census, *Statistical Abstract of the United States*, Vols. 44, 63, 71 and 81.

farm land with respect to farm prices. Yet the ratio of prices, nonfarm/farm, is the crucial quantity whether computed from a base of high or low farm prices. Given a low level of farm prices relative to the prices of land services for nonfarm uses, even where the latter are near zero, land would shift similarly out of agriculture over the long run in other agricultural regions of the nation. While some of the land withdrawal indicated in Table 5.9 has gone into urban uses, a greater proportion has gone into forestry and other less intensive uses as labor has migrated from agriculture. The level of returns in nonfarm relative to farm uses for both land and labor thus are crucial quantities in relation to land supplied for farm uses.

Labor mobility has never been great enough to cause noticeable slackening of land intensity over most of the nation. The rate of migration has to be considerably greater than it was during the 1950's, relative to the magnitude of the remaining labor force, to cause any extensive shift of land from the conventional product mix. The reservation price for land to agriculture in aggregate, except where it has urban opportunity, is in the neighborhood of tax levels and can even drop below this for short periods. For particular commodities in surplus, the reservation price also is low. The return from grazing is so much lower than for wheat over most of the Great Plains that commodity price would need to fall more than 50 percent from 1955 to 1959 levels before much of it would shift to grass. The same is even more true for cropland held in the hands of farmers which could be shifted to trees in the Southeast. With capital shortage and high discount rate, the present value of a forest product harvested 20 to 40 years in the future is extremely low for the individual. Under these conditions, most forest uses cannot compete easily with an alternative employment which returns $2 net per acre each year.[38] More

[38] See Earl O. Heady and Harald R. Jensen, *Farm Management Economics*, Prentice-Hall, New York, 1954, Chap. 8.

frequently, for the individual operator in the Southeast, forest crops have risen because the operator lacked capital for annual crops, with trees springing up under favorable climate and being too expensive to clear after establishment.

Clearly, an important degree of low supply elasticity for land in particular uses stems from labor elasticity and mobility. An abundance of persons have remained to till the land left by those who migrate from it in concentrated crop areas of feed grains, wheat and cotton. But also, low elasticity of capital and credit supply has caused land strongly to resist change in employment. As capital in committed form, machines can hang on for some time before their repair and replacement costs cause large numbers of farmers to crimp use of land. Low elasticity of credit supply to the individual operator, in the quantity extending beyond the highly elastic range tied to equity, acts to prevent shift of land to grass and trees with their longer waiting period. The discount rate for most farmers is not the market rate of interest. Few use variable capital to the level of marginal return (although the level is frequently lower over prolonged periods for fixed capital) because of uncertainty and captial market conventions.[39] The discount rate thus becomes an internal earning level of capital, compounded further because of uncertainty. Even in terms of intertemporal consideration alone, the present value of $1 in even 10 years is small (12 cents) for a farmer whose discount rate is 20 percent as illustrated in (5.63), with V being present value and I being income in the ith year.

$$V = \frac{I_i}{(1 + r)^i} = \frac{1}{(1 + .20)^{10}} = \frac{1}{8.183} = .12 \tag{5.63}$$

Ten years is a period approached in shift of wheat to grass. For 20 years at this rate, a period approached for pulpwood, $1 of future income has a present value of only 2 cents, compared with 83 cents for an annual crop marketed in a year. The capital restraint may operate more practically in the sense of the prolonged period required for family living expenses, before income of any magnitude is generated from investment in livestock under shift to grass. The problem of deferred income and living expenses is even more extreme in forest production. Added to these effects are institutional conditions tending to prevent shift, such as sharecropping and the dependence of landlords retired from farming on income of annual crops.

Government subsidies have undoubtedly been more important in holding land to the current product mix of agriculture than in holding labor to agriculture. This is especially true of policy mechanisms which provided price supports but did not require output restraints, or for those production control programs which allowed shift in each region from one to an-

[39] For some of these, see Earl O. Heady, *Economics of Agricultural Production and Resource Use*, Prentice-Hall, New York, 1952, Chaps. 16 and 17.

other surplus commodity. Still, cessation of price supports and turn to free market prices of agricultural commodities would not cause land to shift greatly in agricultural employment in the span of two years, or even in four years, although a start in this direction would come about. A much greater thinning of population and labor force, expansion of farm size and acquisition of capital per operator would be necessary before the allocation of land among products would change greatly.

CAPITAL INFLEXIBILITY

The reasons for low supply elasticity of agricultural capital already existing in forms for farm production have been explained in some detail. The fact that the "fixed forms" of capital serve in complementary capacity with land, over a large range, helps hold the latter resource to its current uses. Agricultural machines have no less transferability to other industries than obsolete airplanes. Unfortunately, however, they are attached to an industry rewarded less by economic growth than air transportation. While the rate of obsolescence is high in air transportation, growth in air freight has absorbed yesterday's equipment at prices relatively higher than scrap metal price (although this is less true for obsolete railroad equipment, with exodus of labor from passenger transportation).

The supply of capital services in farm forms can be illustrated as in Figure 5.5 where the supply price differs, depending on whether the demand for the particular capital forms is increasing or decreasing. Line *AP* represents a general nature of supply function traced when demand is increasing relative to new technology and the stock of capital items on hand. But during a period of decline in demand, the supply of capital services does not retrace *AP* segment, but rather *PB* until it falls to scrap value or similar reservation price as suggested by *SB* segment. (The relationship may be nonlinear, and without corners, even intersecting the

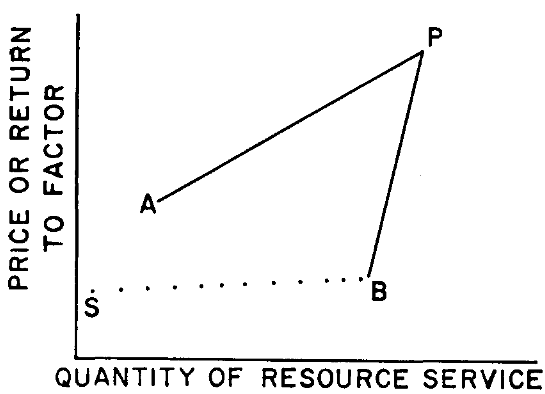

Fig. 5.5. Supply of Capital or Services in Periods of Expansion and Contraction of Return.

horizontal axis for the segment representing decline in commodity demand and price.) That the commodity supply function parallels this nature suggested for resources has been given some quantitative basis as indicated in Table 5.10. Four dairy supply functions, with observations in logarithms, were fitted to years of rising or falling trend and annual prices. While the number of observations is not large for each situation and additional refinement in analysis is desired, the data indicate supply elasticities in respect to price ratio which are lower under falling than under rising prices. Too, differences in elasticities under rising and falling

TABLE 5.10

ELASTICITIES OF MILK SUPPLY RESPONSE FOR LAKE STATES WITH RESPECT TO TIME AND MILK-FEED PRICE RATIO

Price Situation	Years	R^2	Elasticity in Respect to: Time	Milk/feed price ratio
Rising trend and rising annual......	12	.97	.0057 (.0004)	.349 (.136)
Falling trend and falling annual.....	5	.99	.0054 (.0002)	.254 (.042)
Rising trend and falling annual.....	9	.94	.0053 (.0008)	.239 (.108)
Falling trend and rising annual......	7	.99	.0045 (.0003)	.134 (.114)

Source: Randolph Barker, *Milk Supply Functions for Lake States*, Ph.D. thesis, Iowa State University, Ames. (Figures in parentheses are standard errors.)

prices are expected to be less for products such as cattle or orchards, where resources such as machines and buildings can be supplied from outside but new stock must be supplied from within the sector, than for annual crops such as wheat and cotton. Low elasticity of supply for capital funds serves similarly to check expansion during rising prices.

The extreme difference between the Southeast and Southwest in change in structure and commercialization of farms is partly a reflection of variance in credit and capital supply elasticity. But even with these types of restraints on resource supply during expansion periods, product supply elasticity is still greater during periods of rising prices than in periods of declining prices. This is true in dairying, as illustrated by the response functions cited above, even though growth in quantity of stock through breeding is more difficult than reduction through slaughter. Too, the relative reservation price for capital in the form of cattle which can be slaughtered is higher than for field implements which serve only as scrap. As a result, we expect supply elasticities of physical capital to dairying to be more similar during expansion and contraction than for field crops.

As we mentioned previously, and as is consistent with the compensation principles outlined later, supply elasticity could be greatly increased during periods of falling prices if means existed for public purchase of the machines, land and resources which otherwise have low "downward" reservation prices.